PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA
Ministry of Higher Education and Scientific Research
University of Mohamed Khider – BISKRA
Faculty of Exact Sciences
Computer Science Department

Ordre N° :IAGE_Start Up_ /M2/2025

Thesis

Submitted in fulfillment of the requirements for the Masters degree in

Computer science

Option : Applied informatics for business manegemment

Smart tourism platform “My way”

By :YAHIAOUI Baraa
BENSAID Abir
KAHOUL Haithem Sirajeddine
AZRI Soufiane

Members of the jury :

OUAAR Hanane	MCB	President
MERIZIG Abdelhak	MCA	Supervisor
HOUHOU Okba	MCB	Member

Session 2025

Acknowledgements

First and foremost, we express our gratitude to Allah, the Lord of the worlds, for His abundant blessings and guidance throughout this thesis journey.

To our parents, we extend our heartfelt thanks for instilling in us a love for knowledge and consistently encouraging us to strive for excellence. Your unwavering belief in our abilities has been the driving force behind our accomplishments. We are forever grateful for the sacrifices you have made to provide us with the best education and for your continuous support, offering valuable advice, and listening to our ideas.

We would also like to extend our sincere appreciation to our thesis advisors, Abdelhak Merizig and Ali Sriti. Your guidance, expertise, and patience have been instrumental in shaping this thesis. Your insightful feedback and dedicated support have helped us refine our ideas and go beyond our limits.

To our friends and classmates, we are grateful for the close friendship, intellectual discussions, and shared experiences. Your unwavering support and understanding during these challenging times have made this journey more enjoyable and meaningful.

Lastly, we acknowledge and appreciate the contributions of all the participants who generously dedicated their time and shared their insights for this study. Without their willingness to be part of our research, this thesis would not have been possible.

Thank you all for your invaluable contributions, guidance, and support.

الملخص :

تُعد الجزائر بلدًا غنيًا بجماله الطبيعي، وإرثه التاريخي، وتنوعه الثقافي، إلا أنها لا تزال وجهة غير مستكشفة بالشكل الكافي من قِبل السياح المحليين والدوليين. ويُعزى هذا النقص في الاستكشاف السياحي إلى غياب منصة رقمية موحدة وسهلة الاستخدام، تُتيح للمسافرين اكتشاف الوجهات وتنظيم وحجز تجاربهم السياحية داخل البلاد بكل سهولة وفعالية.

يهدف هذا المشروع إلى سد هذه الفجوة من خلال تطوير تطبيق مبتكر يُعرف باسم **My Way**، وهو تطبيق ويب وتطبيق مخصص للهواتف الذكية يُبسط عملية تخطيط الرحلات السياحية في الجزائر. يوفر التطبيق معلومات شاملة حول الوجهات السياحية، أماكن الإقامة، الجولات السياحية، والخدمات المحلية، مع إمكانية تخصيص الرحلة وفقًا لميزانية المستخدم واهتماماته ومدة إقامته.

بالإضافة إلى واجهته الموجهة للمستخدمين، يتضمن التطبيق لوحة تحكم خاصة بمزودي الخدمات المحليين، تُمكّنهم من إدارة عروضهم والترويج لها بسهولة ضمن نظام رقمي متكامل. ومن خلال هذا المشروع، نسعى إلى دعم التحول الرقمي لقطاع السياحة في الجزائر، وتعزيز جاذبية البلاد كوجهة سياحية واعدة، والمساهمة في تنمية الاقتصاد المحلي.

الكلمات المفتاحية :

الجزائر، السياحة، تخطيط الرحلات، تطبيق ويب، تطبيق موبايل، منصة رقمية، تجربة المستخدم، مزودو الخدمات، تخصيص الرحلات، رقمنة السياحة.

Abstract

Algeria is a country rich in natural beauty, historical heritage, and cultural diversity, yet it remains largely underexplored by both local and international tourists. One of the main reasons for this underdevelopment is the lack of a centralized, user-friendly digital platform that allows travelers to easily discover, plan, and book travel experiences within the country. This project aims to address that gap by developing My Way, an innovative web and mobile application designed to simplify and enhance the travel planning process in Algeria.

The platform provides comprehensive information about destinations, accommodations, guided tours, and local services, offering users the ability to personalize their trips based on preferences such as budget, interests, and duration. In addition to its user-focused interface, My Way includes a dedicated dashboard for local service providers, allowing them to manage their offerings and reach a wider audience. By facilitating the digital transformation of tourism services, this project contributes to the promotion of Algeria as an attractive travel destination and supports local economic development.

Keywords : *Algeria, tourism, travel planning, web application, mobile application, digital platform, user experience, local service providers, trip customization, tourism digitalization.*

Contents

Acknowledgements **i**

Abstract iii

Table of Contents **vii**

List of Figures **viii**

List of Tables **1**

1 Tourism:State of the Art **5**

1.1 Introduction 5

1.2 Digital transformation in tourism 6

1.2.1 The impact of tourism 8

1.3 The State of Digital Tourism in Algeria 9

1.3.1 Government and Official Tourism Websites 10

1.3.2 Challenges and opportunities in the algerian context 11

1.4 Review of International Platforms 12

1.4.1 TripAdvisor, Booking.com, GetYourGuide 12

1.4.2 Comparative Analysis 13

1.4.3 Critical Review 14

1.5 Recommendation Systems Based on User Profiles 15

1.6 Conclution 16

2 Analysis and Specifications **18**

2.1 Introduction 18

2.2 Needs Analysis . . . 18
2.2.1 General Objective . . . 19
2.2.2 Specific Objectives . . . 19
2.3 Specifications . . . 21
2.3.1 System Description . . . 21
2.3.2 Identification of Actors . . . 22
2.3.3 Functional Requirements . . . 24
2.3.4 Non-Functional Requirements . . . 25
2.3.5 Constraints . . . 26
2.4 Tools and Technologies Used . . . 26
2.4.1 Frontend . . . 26
2.4.2 Backend . . . 27
2.4.3 Database . . . 28
2.5 Conclusion . . . 28

3 System Design **30**

3.1 Introduction . . . 30
3.2 System architecture . . . 31
3.2.1 Client-server architecture . . . 31
3.2.2 Clean architecture . . . 32
3.3 Definition of System Modules . . . 33
3.4 Web and Mobile application architecture . . . 36
3.4.1 Web application architecture . . . 37
3.4.2 Mobile application architecture . . . 38
3.5 UML Diagrams . . . 38
3.5.1 Use case diagram . . . 39
3.5.2 Sequence diagram . . . 40
3.5.3 Class diagram . . . 41
3.6 Used Algorithm . . . 42
3.6.1 Collaborative Filtering . . . 42

3.6.2 **Matrix Factorization:** . . . 42
3.7 Conclusion . . . 44

4 Implementation and Development **46**
4.1 Introduction . . . 46
4.2 Development Environment . . . 46
4.2.1 Development Tools . . . 47
4.2.2 Backend Development and API Tools . . . 49
4.2.3 Database Management . . . 50
4.2.4 API Development and Testing . . . 50
4.2.5 Version Control and Collaboration . . . 51
4.2.6 Design Tools . . . 51
4.3 Interface System . . . 52
4.3.1 Interface system for web Application . . . 52
4.3.2 Interface system for mobile Application . . . 59
4.4 Conclusion . . . 64

References **67**

List of Figures

3.1 Client-Server Model. . . . 31
3.2 Clean Architecture [1]. . . . 33
3.3 Diagram of System Modules. . . . 34
3.4 Architecture of web and mobile application. . . . 37
3.5 Use Case Diagramm. . . . 39
3.6 Sequence Diagram. . . . 40
3.7 class diagram. . . . 41

4.1 Home page. . . . 52
4.2 Sign In and Sign Up. . . . 53
4.3 Request new service. . . . 54
4.4 Admin dashboard. . . . 55
4.5 General informations. . . . 56
4.6 Add offer. . . . 56
4.7 Rooms management. . . . 57
4.8 Agency offers. . . . 58
4.9 Manage the list of services. . . . 59
4.10 Home page. . . . 59
4.11 Login. . . . 60
4.12 Request new service. . . . 61
4.13 Voyage details entry form. . . . 62
4.14 Sorting and filtering panel. . . . 63
4.15 Hotel offers. . . . 64

List of Tables

1.1 Evolution from Tourism 0.0 to Tourism 4.0 [2] 6
1.2 Comparative Analysis of International Platforms and Algerian Platforms 14
3.1 Evaluation matrix between users and services 44

General Introduction

General Context

Algeria, the largest country in Africa, is a land of remarkable contrasts and rich cultural heritage. From the pristine waters of the Mediterranean coast to the vast expanses of the Sahara Desert, from ancient Roman ruins to bustling traditional markets and majestic mountains, Algeria offers a uniquely diverse travel experience. The country's tourism potential is immense, with historic cities such as Timgad, Djemila, and Tipaza, the breathtaking Tassili n'Ajjer plateau, and the oasis towns of the south offering a wealth of attractions.

In recent years, tourism has become a vital pillar of economic growth and cultural exchange in many countries. As global travelers increasingly seek authentic and off-the-beaten-path destinations, Algeria stands out as a promising alternative. However, despite its rich heritage and natural beauty, Algeria remains largely unexplored by both local and international tourists. While neighboring countries have successfully developed tourism infrastructures and digital ecosystems to promote travel, Algeria continues to face major gaps in this area.

Problem Statement

Despite this abundance of natural and cultural wealth, Algeria remains one of the least-visited countries in the region. Tourism contributes only a small fraction to the national gross domestic product (GDP), and the number of international tourists is far lower compared to neighboring countries. This paradox is largely due to several persistent challenges, including:

- The absence of digital tools for travel planning and reservation.
- Poor promotion and accessibility of local tourism products.
- Limited integration between service providers (accommodation, transport, tours).

- Lack of user-friendly solutions adapted to the needs of both local and foreign tourists.

Currently, travelers—both Algerian and foreign—face numerous difficulties when planning domestic trips within Algeria. Unlike hotels, airlines, and international tourism platforms, there is no centralized digital platform that provides comprehensive and reliable information about destinations, accommodation, transportation, guides, or experiences. Instead, travelers must rely on fragmented sources such as social media pages, travel forums, or word-of-mouth recommendations. This disorganization undermines the reliability and appeal of domestic travel. Moreover, many local travel agencies and service providers struggle with digital transformation and lack the visibility required to reach their target audience.

Objectives

To address these issues, we are developing My Way, an innovative mobile and web application designed to revolutionize how travel is planned and experienced in Algeria. The main objectives of this project are:

- To design and develop an intuitive, centralized platform for discovering, comparing, and booking travel experiences across Algeria.
- To provide rich, organized content about tourist destinations, accommodations, itineraries, and services.
- To enhance user experience based on insights from previous usage patterns by personalizing content and proactively suggesting relevant services or destinations tailored to user preferences.
- To allow users to personalize their trips according to preferences, budget, and duration.
- To empower local service providers through a dedicated dashboard, improving their visibility and digital presence.
- To contribute to the digital transformation of the Algerian tourism industry and promote sustainable, local tourism.

Organization of the Thesis

First, we have Chapter 1, which presents the state of the art by introducing the general context, defining key concepts, and reviewing existing work in the field. Then, Chapter 2 focuses on the analysis of user needs, outlines the system specifications, and describes the tools and technologies selected for the project. Next, Chapter 3 covers the design phase, including system architecture, UML diagrams, data modeling, and the definition of system modules. Following that, Chapter 4 discusses the implementation and development process, highlighting the development environment, module implementation, and the results obtained.Finally, the General Conclusion summarizes the work accomplished throughout the thesis and suggests possible directions for future improvement.

Chapter 1

Tourism:State of the Art

1.1 Introduction

In recent years, the fast-paced evolution of digital technologies has had a major impact on the tourism industry. Tools like mobile apps, websites, social media, and artificial intelligence have completely changed how people plan, book, and enjoy their trips. This major shift is known as the digital transformation of tourism. It has not only changed how tourists interact with service providers and destinations but has also opened up new opportunities — and challenges — for both the public and private sectors.

This chapter offers a clear overview of where digital tourism stands today. It starts by looking at how digital transformation is reshaping the tourism sector and influencing economies, cultures, and tourist behavior. Then, it takes a closer look at Algeria, highlighting a case study on the country's digital tourism efforts, especially focusing on government initiatives and local projects.

1.2 Digital transformation in tourism

The simplest definition of tourism is the act of traveling, whether for business or pleasure. However, having fun and relaxing are typically the main motivations for traveling. Most people's main goal is to spend a suitable amount of time away from home and anything that relates to work while taking advantage of commercial services in an effort to unwind. People who work in the tourism industry are typically called tourism professionals . A number of trips around various sites or popular tourist destinations make up the tourism process. The six as of tourism refer to a few key components that are connected to the industry. These are referred to as Activities, Packages, Amenities, Attractions, Accessibility, and Ancillary Services. the tourism industry is the entirety of the activities and events connected to a significant journey of people, and in this context, tourists, move from one location to another that are mainly away from their primary abode. The tourism industry is one of the biggest in the world and one of the most lucrative in terms of national wealth generation and economic expansion. Several countries are big on their tourism industry and they pump in so many resources into their tourist attraction locations to make it up to global standards as that has been proven to ensure huge returns for them economically.[3]

Tourism 0.0	**Tourism 1.0**	**Tourism 2.0**	**Tourism 3.0**	**Tourism 4.0**
Processes enabling technology (reservation and distribution systems), Almost inexistence consumer-enterprise technology-based interaction, Phone and fax were main distance communication tools	Millions of global users, Homepages, Focused on enterprises, Owning contents, HTML, portals, Web portals, Page views, clickstream, Advertising, Taxonomy	Billions of users, Blogs, SNS, Focused on communities, Sharing contents, XML, RSS, Web applications, Cost per click, ad click rate, Word of mouth, Folksonomy	Multiple forms, Lifestream, Consolidation dynamic content, Semantic web, Widgets, drags and drop markups, User engagement, Advertisement, Meonomy	Artificial intelligence, Big data, Internet of Things, Blockchain, Cloud computing, Virtual and augmented reality, High performance computing, Lifestream

Table 1.1: Evolution from Tourism 0.0 to Tourism 4.0 [2]

The table shows the evolution of tourism through web technologies. According to Borges Tiago et al.[2], the development of tourism in tandem with online technology can be divided into five distinct phases. Each stage represents a substantial change in how technology, service providers, and tourists interact.

- **Tourism 0.0:** This period refers to the pre-internet era, where technology was predominantly used in back-end operations such as reservation and distribution systems. There was virtually no personal contact between customers and companies, except via telephone and fax. In this phase, technology had no direct role in enhancing the client experience.

- **Tourism 1.0:** Parallel to the Web 1.0 model, this stage introduced static homepages and enterprise-oriented portals managed solely by organizations. User interaction was minimal and content delivery was one-way. Metrics for engagement included page views and clickstreams. Advertisements were mainly in the form of display banners, and information was categorized using rigid taxonomies.

- **Tourism 2.0:** Reflecting Web 2.0 principles, this phase emphasized user-generated content and interaction. Peer reviews, collaborative filtering, and the sharing of travel experiences flourished via blogs and social networking sites (SNS). Technologies like XML and RSS enabled dynamic applications and content. Marketing models shifted to cost-per-click and ad click rates, and traditional taxonomies gave way to folksonomies or user-generated tags.

- **Tourism 3.0:** This stage brought more personalized and immersive experiences enabled by semantic web technologies and real-time content consolidation. Users engaged through tools such as lifestreaming, widgets, and drag-and-drop interfaces. The concept of "Meonomy" emerged, allowing users to curate travel experiences based on their individual preferences, orientation, and context.

- **Tourism 4.0:** Representing the most advanced stage, Tourism 4.0 integrates cutting-edge technologies such as cloud computing, blockchain, big data analytics, artificial intelligence (AI), and the Internet of Things (IoT). It enables high-performance computing, real-

time data processing, and highly personalized intelligent travel services. Technologies like virtual and augmented reality enhance user immersion by offering simulated experiences that assist in travel planning. Digital transformation and smart tourism converge at this stage, with data-driven systems predicting user needs and delivering adaptive, context-aware services.

1.2.1 The impact of tourism

The first impact of tourism is the economic impact. Tourism helps to generate local employment either directly into the industry or indirectly in the other sub sectors related to tourism [4]. Growth in the industry helps stimulate more profit in the other related industries domestically. For example, sectors like the hotels, accommodation facilities, restaurants and individual catering facilities, transport, and entertainment as well as the retail industries are all able to grow their revenue under tourism. Also, the tourism industry helps to generate foreign exchange for the benefit of the country's economy. In this manner, capital resources are effectively mobilized, facilitating the generation of new financial inflows. Locally, tourism is beneficial as it helps to diversify the economy towards improved infrastructure. Tax revenue increases because of the activities in the tourism sector. However, increased tourist activity can raise the cost of land, housing, and essential goods. There may also be an increase in the provision of health care services as well as security [5].

Tourism also bears social impact on the country by improving the standard of the community through an improved economy. Besides, cultural facilities and recreational facilities can be employed to benefit the local communities while it does the same for tourists. Also, the general community outlook is constantly developed to suit the global standard it wants to be known for. The esteem of the members of the local community is further boosted as they enjoy the prestige that comes with being from a location of tourism. This also proves to be a foundation of better understanding despite diversity among the people [6].

Another great impact tourism has on a nation is cultural. As is well known, tourism and culture are intertwined as the culture of the community communicates the experience as a whole. For instance,culture adds colour and spice to the tourist's journey. More so, a traveller may be unable to remember the details of the history of the location visited and many of the related mat-

ters. However, the cultural experience is one that would be forever imprinted on the mind of the traveller. Tourism helps to improve cultural awareness. In addition, revenue can be generated and are instrumental in preserving historical monuments, archaeological sites and landmarks of antiquity. Although, there are levels of criticism about the delusion of culture and its importance being constantly diluted, culture is only preserved through sharing. Tourism helps culture to flourish when it is exchanged for the mutual benefit of the local hosts and travel visitors [7].

Also, tourism holds a great impact on the environment because it creates more awareness for the community. Through awareness, there is the preservation of the environment for the posterity.

1.3 The State of Digital Tourism in Algeria

Algerian digital tourism, reflected by the fragmented nature of its initiatives online and the country's limited international reach, is still in the early stages of development. Though Algeria has enormous potential for tourism–from the vast Sahara to its historic towns and coastal areas–digital platforms that promote travel services are not yet fully transnational.

A comparative study of Algerian tourism websites such as visitalgeria.dz, portail.mta.gov.dz, and algeriatours.dz reveals significant disparities in web traffic, mobile responsiveness, and user engagement when compared to international platforms like goturkiye.com . For example, while goturkiye.com achieved over 10 million visits in October 2024, the Algerian Tourism Promotion Portal had only 621 visits in the same period, highlighting the need for improved visibility and engagement [8].

One of the biggest problems is that they're not optimized for mobile devices: the Algerian sites rely heavily on desktop access—some up to 100%. in some cases — when international platforms tend to attract over of visits of their traffic via mobile devices [8]. This gap showcases an overriding weakness in user experience design that reduces accessibility for modern travelers.

The National Tourism Office (ont. dz) and the Agency Touring Algeria, likewise not far behind, are two particular projects attempting to implement booking tools, travel information and user-friendly products, but there is still little evidence of coherent management, responsive de-

sign and participation on social media platforms for the whole digital infrastructure.

1.3.1 Government and Official Tourism Websites

In recent years, Algeria has exerted considerable efforts to promote its huge natural, historical and cultural heritage, in particular by developing websites. Official tourism websites have become the main entrance point of both domestic as well as foreign tourists. The official tourism websites provide in-depth information about destinations, help tourist plan their holidays, and offer access to important tourist services.

- **Algeria Tourist Routes**

  Hosted on the domain *algeriatours.dz*,this portal highlights Algeria's most popular tourism destinations with an easy-to-use interface. It offers a range of itineraries via important areas, such as the huge Sahara Desert, the Atlas Mountains, and the Mediterranean coastline. It allows users to look for lodging, dining options, and authorized tour companies in addition to displaying sights.[9].

- **Algerian Tourism Promotion Portal**

  Accessible via *visitalgeria.dz*, this extensive web platform highlights Algeria's beauty and diversity in tourism. It includes detailed information about desert architecture, seaside sites, hilly landscapes, and historical monuments (such Roman ruins). Additionally, the portal offers improved features like interactive trip arranging tools, recommended tour packages, and connections to regional travel companies. [10].

- **Public Service Portal for the Tourism Sector**

  Located at *portail.mta.gov.dz*, the goal of this administrative platform is to streamline processes in the travel and tourist industry. It enables consumers to file complaints about services, obtain sector-specific legislation, and apply for licenses. In addition to its administrative function, it promotes openness and efficient communication between the public and the Ministry of Tourism, which helps to create a more effective and responsible travel environment. [11].

Together, these platforms reflect a growing awareness of the importance of digital

infrastructure in enhancing Algeria's tourism ecosystem and reaching broader audiences in the competitive global tourism market.

1.3.2 Challenges and opportunities in the algerian context

The Algerian tourism sector currently entering a phase of digital transformation, driven by global trends and local efforts. However transformation is marred by several challenges that prevent them from being well integrated with the latest digital tools and in turn by many opportunities for growth if appropriately taken into account.

Challenges

One of the major challenges is a low level of digital infrastructure, in particular in rural and remote areas, wherein lack of Internet access prevents the availability of digital platforms for tourism promotion and management.[12].

Another problem is the low level of digital literacy among stakeholders in tourism, particularly small and medium-sized undertakings (SMEs), whose workers are ill-prepared to make use of digital technology in their marketing, communication and online booking activities.

The lack of development in electronic payment systems is also a serious obstacle to the growth of digital tourism, since many Algerian Web portals are not connected to secure and efficient payment gateways, thus deterring the online tourist from completing transactions..

Moreover, the regulatory environment is not yet fully supportive of digital startups in the tourism sector. Bureaucratic complexity and limited institutional support make it difficult for innovative platforms to emerge and scale [13].

Additionally, public mistrust in digital systems—stemming from concerns over cybersecurity and data protection—continues to impede the adoption of online services in the tourism market [14].

Opportunities

Yet in spite of these limitations, Algeria presents a unique position for digital tourism development: the increasing diffusion of the internet and the rising use of social media offer ideal

conditions for design of digital marketing and online engagement strategy.[15].

The government has recently launched initiatives to support digital transformation in all sectors of the economy (including tourism), including investment in digital infrastructure, promotion of public-private partnerships and strategic planning on tourism development. [16].

There are also increasing numbers of tech-savvy entrepreneurs, developing tourism oriented digital platforms that offer services like hotel booking, virtual tours and local guide networks - and these are going to bring a lot of innovation and flexibility to the market. [14].

Furthermore, the lack of established local e-payment solutions presents an opportunity for fintech development tailored to the tourism context. Establishing reliable, secure, and easy-to-use systems can significantly improve customer experience.

Finally, the increasing influence of digital content creators and travel influencers on platforms like Instagram, TikTok, and YouTube offers a modern channel to promote Algerian destinations to global audiences [15].

1.4 Review of International Platforms

International platforms have played a dominant role in the digital transformation of many industries in recent years, including tourism. The international platforms for innovation/digital collaboration provide tools, frameworks and best practices, to foster innovations, global collaboration and foster the adoption of digital solutions. In this section, we introduce major international platforms for digital development and development of tourism worldwide.

1.4.1 TripAdvisor, Booking.com, GetYourGuide

Digital tourism platforms in the international virtual travel market have changed how people plan, book and share their travel with customers around the world. This sub-section presents brief case studies of the three major online portals – TripAdvisor, Booking. com and GetYourGuide.

TripAdvisor was started in 2000 as one of the world's first online travel rating and review services. The service largely depends on its user-generated content from millions of travelers submitting their own reviews, ratings and photos to the site on hotels, restaurants, attractions,

etc. This service is complementary to a typical website offering travel reviews as well as a meta-search engine recommending booking partners for eventual booking [17].

Booking. com is a booking site for hotels, flights, airport taxis and travel packages and was founded in 1996 in the Netherlands. Its reputation is built around its vast inventory and dynamic pricing model, as well as their focus on user experience and language support. booking. com is consistently rated among the best by users after having a good user experience, their mobile apps and customer ratings [18].

GetYourGuide was founded in 2009, specialized in tourism experiences and activities (e. g. guided tours, entry tickets to attractions, cultural visits). It connects travelers with their relevant service providers to ensure the most tailored and local experience possible. GetYourGuide's focus is on mobile usage, flexibility of booking, and real time availability in order to appeal to younger, tech-savvy tourists [19].

1.4.2 Comparative Analysis

To better understand the current landscape of digital tourism platforms, a comparative analysis is conducted between globally recognized platforms TripAdvisor, Booking.com, and GetYourGuide and existing Algerian platforms. The comparison is based on key criteria such as platform focus, user interface design, content sources, technology integration, and target audience. This analysis highlights the strengths of international platforms and identifies potential areas of improvement for Algerian counterparts.

Criteria	**TripAdvisor**	**Booking.com**	**GetYourGuide**	**Algerian Platforms**
Main Focus	Reviews and Recommendations	Accommodation Booking	Activities and Experiences	General Information
User Interface	Advanced and Interactive	Highly Optimized and Responsive	Mobile-First, Experience-Focused	Often Static and Outdated
Content Source	User-Generated Content	Verified User Reviews	Curated Local Experiences	Mostly Official / Limited User Input
Technology Integration	AI, ML, APIs, Cloud	ML, AI, Real-Time Booking	AI, Geo-Location, APIs	Limited or Absent
Target Audience	Global (All Travelers)	Leisure and Business Travelers	Young, Experience-Driven Users	Domestic and Limited International

Table 1.2: Comparative Analysis of International Platforms and Algerian Platforms

This comparison shows that while international platforms are data-driven, personalized, and engaging, Algerian tourism platforms often remain informational, lacking interactivity and real-time functionalities.

1.4.3 Critical Review

- Algerian digital tourism initiatives face several challenges:

- Limited Technological Infrastructure: Many platforms lack essential technologies like APIs, recommendation engines, and responsive mobile design [12].

- Content Management: Although TripAdvisor (and its ilk) are based on user generated content, Algerian tourism website offerings remain rather static with few avenues for user interaction and feedback.

- Integration: lack of linkage between tourism agencies and local tourist guides, hotels and restaurants, as a result of which a lack of unified platforms are not possible.

- Low Visibility and Marketing: As with many global brands that are heavily invested in SEO and digital marketing, Algerian sites are not well-indexed and thus have a limited

international reach.

- However, there are also notable opportunities:

- Natural and Cultural Assets: Algeria has huge potential for tourism (from the Sahara to Roman ruins, apparently) which could be digitally promoted.
- Increased Youth and Technical Use: Young, digitally literate people have a huge user base ready to adopt smart tourism tools.
- Governeral Interest in Digitalization: Government efforts to support the digital transformation have, as recent research has shown, been gradually increasing [12].

This critical analysis not only underlines the need of Algeria to learn from international best practices, but also to adapt them to the local realities, with particular emphasis on user experience, technology appropriation and co-creation of content in order to create a viable and modern tourism ecosystem.

1.5 Recommendation Systems Based on User Profiles

Recommendation systems are a core component of many modern digital platforms, aimed at personalizing user experiences by suggesting relevant items, services, or content. One prevalent approach in the design of these systems is the use of *user profile-based recommendation*, which leverages individual user data to generate tailored suggestions. This technique is widely utilized in domains such as e-commerce, tourism, e-learning, and entertainment.

A **user profile** is a structured representation of information related to an individual user. It typically includes:

- **Demographic details**: e.g., age, gender, location
- **Behavioral data**: e.g., click history, purchase history, ratings
- **Explicit preferences**: e.g., favorite categories or keywords

The profile serves as the foundation for understanding user interests and predicting future behavior.

User profile-based recommendation systems can be classified into two main types:

- **Content-Based Filtering**: This approach recommends items that are similar to those the user has liked in the past. It relies on the attributes of items and matches them with the features derived from the user profile. For instance, in a tourism application, if a user frequently engages with desert excursions and traditional cuisine experiences, the system will recommend similar activities or destinations.

- **Hybrid Systems**: These combine user profile data with collaborative filtering or other techniques to enhance recommendation accuracy. The integration aims to mitigate the limitations of relying solely on one method, such as the *cold start problem* or *sparsity issues.*

1.6 Conclution

In this chapter, we examined the progression of digital change in the tourism industry with international perspective alongside Algerian one. An analysis of international platforms like TripAdvisor, Booking.com, and GetYourGuide, showed us the impact of technology, consumer participation, and advanced services on the experience and management of tourism. These platforms illustrate the impact of digital technologies in amplifying exposure, customization, and consumer satisfaction.

On the other hand, the Algerian's digital penetration level in tourism is very limited and the sector suffers from a range of problems such as insufficient infrastructure, absence of integrated systems, and low levels of consumer engagement. Nevertheless, the unique natural and cultural resources of the country, coupled with some recent steps taken by the government, boost the speed of development.

The significant gaps and weaknesses that need more efforts were revolve around comparative analysis. This is paving the way for formulating practical solutions which will be discussed in the upcoming chapters. It is now clear that a digital transformation in Algerian tourism is

feasible and it will help meet current traveler needs and improve Algeria's competitive position in the international tourism market.

Chapter 2

Analysis and Specifications

2.1 Introduction

The tourism sector is one of the most vital sectors witnessing an increasing digital transformation across the world. Digitalization has become a key factor in improving the tourist experience, enabling them to easily search, plan, and book on advanced online platforms. Despite Algeria's vast tourism potential, the lack of dedicated digital tools makes exploring destinations and organizing trips difficult for many visitors. Based on this problem, this project aims to address this gap by developing a multiplatform digital system (a mobile application and a web application) that allows users to discover Algerian tourist attractions, pre-book services and evaluate tourist experiences.

In this chapter, we conducted a comprehensive analysis of the needs of the various stakeholders in the system and identified the essential functions that the application should provide. We also prepared a specification that outlines the system's technical and functional characteristics and requirements, along with a detailed review of the tools and technologies selected to develop this project, justifying each choice based on the nature of the required tasks.

2.2 Needs Analysis

Before the design and development of the platform can be launched, there should be a careful examination of the needs of the users. This helps in ascertaining the expectations, problems, and requirements of the main actors — tourists, service providers, and administrators —

clearly. Understanding these needs ensures that the system will provide relevant, beneficial, and simple-to-use functions that address real problems in the tourism process, especially in the Algerian context.

2.2.1 General Objective

The typical goal of this project is to design and develop an integrated, multi-interface virtual platform (website and mobile application) that permits customers to discover traveller locations in Algeria in a smooth and seamless manner. Additionally,it gives the cappotential to devise and prepare journeys and book diverse tourism offerings online, consisting of accommodation, transportation, cultural and environmental activities, and more.

The platform seeks to bridge the virtual hole dealing with the tourism sector in Algeria by presenting a reliable, secure, and responsive virtual answer that meets the needs of local and foreign tourists. This contributes to enhancing the quality of tourism offerings, facilitating traveller decision-making, and improving tourism funding possibilities by permitting local stakeholders to showcase their offerings expertly.

The project aims to contribute to the digitalization of Algeria's tourism sector by providing a feasible model that can be enhanced over time depending on the emerging technologies to ensure performance, security, and usability across platforms.

2.2.2 Specific Objectives

- **Analyzing local and international digital tourism needs**
  - Studying user behavior in the tourism sector through comparisons with global applications.
  - Identifying gaps in digital tourism in Algeria.
- **Identifying target user requirements**
  - Identifying the basic characteristics required by each user type (tourist, hotelier, tour guide, etc.).

  - Translating these needs into actionable technical specifications.

- **System Specification Preparation (Specification sheet)**
  - Comprehensive definition of the system's main functions (e.g., destination search, account creation, reservation, etc.).
  - Define non-functional requirements such as security, scalability, and compatibility with different devices.

- **System Architecture and Graphical Modeling Design**
  - Create UML diagrams (use cases, sequences, classes) to illustrate the system flow.
  - Prepare the data model (MCD and MLD) if using a PostgreSQL database.

- **Selecting appropriate tools and technologies**
  - Using Flutter on mobile and React on the web to provide optimal user experience.
  - Using. NET to write the back end code because it is powerful and also secure.
  - PostgreSQL as a robust and scalable database.
  - Using Figma for professional user interface design.
  - Organization of workflows,using GitHub and UML in order to maintain traceability and organization.

- **Develop a functional prototype**
  - Program core functions such as account creation, search for a service, view service details.
  - Support for two languages (at least Arabic and English) remains versatile for tourists.

- **Effectiveness testing and results analysis**

- Conduct a real user experience.
- Collect feedback and identify areas for improvement.
- Provide suggestions for future improvement and expansion.

2.3 Specifications

the official specifications that will govern the tourism platform development. It serves as a contractual and technical foundation, aligning the system's design and realization to the identified needs of its users and stakeholders. The needs encompass the system's overall description, functional and non-functional requirements, main features, and operational constraints of the system. By establishing clear expectations and technical boundaries, this document ensures a controlled and coherent development process leading to a stable and user-centered solution.

2.3.1 System Description

The mobile and web applications combine to create a system that enhances tourism through user, service provider, and administrator interaction. Enhanced information that is specific to their profiles is now available to tourists through tablet technology which is increasingly accessible to all age groups.

Mobile Application: On-the-go tourists can plan trips with ease using the app. Users can browse through tourist destinations, services, and available activities. Making reservations and communication with service providers is seamless with the application.

Web Application: Exceptional business tools are provided to service administrators and providers. Besides managing and listing tourism services, the administrator has system oversight responsibilities, content management, user management, and service quality control.

Core functionalities such as service registration, account creation, reviews, notifications, and interaction with users are supported by the system, all while streamlining the delivery of other daily services. Effortless adaptability for organizational changes, reduced complexity, and multi-module integration for improvement empowers and enables the system's great internal flexibility.

2.3.2 Identification of Actors

Identifying actors is particularly crucial in system analysis because it aids in understanding the different kinds of interactions within the system and their relation to the needs of each user type. In the scope of this project, three primary actors were recognized who work with the system based on a clearly defined role and set of functions:

1. **Tourist**

   Role: The tourist is the common system user, standing for people who use the platform to navigate through, plan, book trips, and view available services with booking and rating features.

   Key interactions with the system

   - Browse for destinations, accommodations, and available activities.
   - Search and filter by location, price, or activity type.
   - Set up a personal account and edit the profile.
   - Make reservations through the platform (hotel, tourist activity, etc.).
   - Correspond with service providers through the system.
   - Make the most from suggestions or available information regarding trips and tours.

   Objective

   - Gain easy access to various tourist offers in Algeria.
   - Have secure and easy digitally serviced trip planning.
   - Access a unified and reliable platform.

2. **Service Provider**

   Role: Service providers include hotels, travel agencies, tour guides, and tour drivers, whose role is to display and manage their services on the platform.

   Key interactions with the system

   - Register and edit associated Service Provider account.

- Post offers and services: accommodation, tours, activities…
- Add appropriate photos, videos, descriptions, and pricing.
- Manage availability, track and confirm reservation requests.
- Answer user questions.
- Monitor feedback and ratings received from clients.
- Evaluate and adjust posted services as necessary.

Objective

- Enhance marketing prospect effectiveness.
- Improve service promotion.
- Execute proper reservations digitally and communicate seamlessly with customers.
- Enhance accuracy and professional demeanor.

3. **Administrator**

   Role: An administrator has the highest power over the entire platform supervising its technical, organizational, content, and stakeholder interaction features quality control.

   Key interactions with the system

   - Manages user accounts (tourists and service providers).
   - Accepts/declines service provider registration requests.
   - Moderates content and publishes it only after validating its credibility.
   - Oversees platform maintenance of technical and security systems.
   - Creates and distributes statistical information regarding global users of the platform.
   - Publishes managed public and periodic notifications.

   Objectives

   - Provides balanced and safe operations of the platform.
   - Implements and supervises standards for services and content provided.
   - Control and enforce system rules and policies.

2.3.3 Functional Requirements

These requirements are the functional requirements which the system must satisfy to satisfy user requirements (depending on the type of user (tourist, service provider or administrator)).

1. **Account Management**
    - Enabling tourists and service providers to register via email or phone number.
    - A secure password login system with error alerts.
    - The ability to update profiles (name, photo, contact information, etc.).
2. **Browse and Explore Services**
    - Tourists can search offers for tourist service by category (hotels, restaurants, activities, etc.).
    - A smart search filtering system (by region, price, rating, etc.).
    - A photographic, description, location map and service rating of the various services.
3. **Content Management by Service Providers**
    - Service providers can add, modify, or delete services.
    - Service providers allow for price-setting, availability-addressing, and maximum number of customers.
4. **Ratings and Reviews System**
    - Visitors can rating the service between 1 and 5 stars upon use.
5. **Administrator Control Panel**
    - User Management: Deactivate, activate, or monitor accounts.
    - Content monitoring (services, reviews, offers..).
    - Sending alerts or announcements to users.
6. **Notification system**

- Notifications of updates and special offers.
- Support for in-app and email notifications.

2.3.4 Non-Functional Requirements

1. **Security**
    - passwords and account information must be encrypted.
    - Each account type has a defined Permission system to block access based on account type.
2. **Reliability**
    - The system should have an acceptable degree of stability without frequent failure.
    - Ensure continual service even when heavily used.
3. **Responsiveness**
    - Time to load the page and the user interface.
    - Quiet prompt to operations.
4. **Usability**
    - User-friendly and intuitive interface for all classes of users.
    - Arabic and English language support.
5. **Scalability**
    - Ability to expand capabilities in the future without damaging the system.
    - Support a large number of users and services.
6. **Maintainability**
    - Use system's code organization and structure for subsequent modifications.
7. **Compatibility**

- Support multiple devices and browsers.
- Works with major smartphone OS: Android, iOS.

2.3.5 Constraints

1. **Always-On Internet Connectivity**: As its features, including destination listing, booking, and updates, are synchronized with the server in real-time, the application needs the internet to be accessible without interruption.

2. **Balanced and Optimized System Resources:** A given system scenario should accommodate a reasonably high number of simultaneous users without having any negative impact on performance. Meeting this goal demands excellent backend system design, adequate maintenance of database systems' data access paths, and suitable system resources.

3. **Proactive and Versatile Design System:** User interfaces such as smartphone and tablet screens of varying sizes and dimensions should be supported.

2.4 Tools and Technologies Used

This section offers an extensive review of the technologies and development tools used during the course of implementing the tourism platform. The choice was guided by the functional needs of the system, performance demands, scalability requirements, as well as the desire to provide an uninterrupted user experience on various platforms. The selected technologies cut across frontend and backend layers, database management, UI/UX design, modeling, and version control creating a solid and contemporary technology stack aligned with the objectives of the project.

2.4.1 Frontend

The frontend is the section where the interaction takes place, either by a tourist, service provider or a administrator.

1. **Flutter**

Google's open-source framework for building mobile applications (Android and iOS) with a single codebase.

Key Benefits:

- Creating clean and appealing interfaces.
- And the speed and quality of servicing the user is excellent.
- Works on multiple platforms.
- Suitable for tourists who wish to effortlessly navigate and book services.

2. **React.js**

   A JavaScript library for constructing rich interactive and responsive web user interfaces.

   Key Benefits:

   - Based on buildable components.
   - Useful for multiple dynamic web applications like admin and provider dashboards.
   - Wide community and support developers.

2.4.2 Backend

The backend is the core center of how a system functions: it stores data, processes it and undertakes any business oriented activities. We utilized:

.NET Core: This is a powerful and dynamic framework from Microsoft for developing service applications and application programing interfaces (APIs).

Key Benefits:

- Data provided by users is well secured.
- The speed of system operation is remarkable particularly where sensitive databases and transactions are involved.
- Connection to databases like PostgreSQL is excellent and easy.
- Services can be deployed on different servers with ease, meaning there is improved scalability and lowered deployment difficulty.

2.4.3 Database

PostgreSQL

is a relational open-source database (RDBMS) notable for its significantly high levels of data security as well as efficient data handling. It is common in complex systems like web applications.

Key Features:

- Support for Spatial Data: PostgreSQL is supported by the PostGIS extension natively which supports the storing and querying of geographic data. It supports tourism applications by enabling the visualization of geographic locations and routes as well as maps.
- High Reliability: Using a variety of powerful transaction control methods, PostgreSQL maintains the integrity and reliability of databases during outages or failures.
- Support for Complex Queries: Through its query language (SQL), PostgreSQL supports complex business logic in a database through sophisticated interrelations, aggregations, functions, and procedural storing, which are provided by advanced relations, aggegrations, functions, and stored procedures.
- Excellent Performance and Scalability: becomes Reliable: the system can be subjected to large volumes of data and many users simultaneously without effecting the general performance of the system.
- Security: Tackles all aspects of access control and encryption of user data with the adequacy required.

2.5 Conclusion

Conclusively, we bound the scope of the system to be developed in this chapter. A thorough examination concerning the intentioned users - the tourists, service providers, and administrators was performed. We defined the system's major functions and requirements as well as nonfunctional prerequisites that would guarantee seamless and secure interaction for users.

Moreover, we described the general guidelines regarding the technologies in the work document 'Specification', which will inform the entire project development cycle and maintain its alignment with the project's goals. The selected tools and technologies assured performance, scalability, and interoperability.

Chapter 3

System Design

3.1 Introduction

This chapter shows the plan for a tourism app that combines web and mobile parts to promote tourism. The plan is based on a Client-Server setup and adheres to Clean Architecture ideas to keep it simple, flexible, and easy to maintain.

We start by showing the System Architecture and explaining how the front end, back end, and database work together with service joining.

Next, we show some key UML Diagrams, such as use case, class, and sequence diagrams, to illustrate system actions and layout.

Then comes Data Modeling where the Conceptual Data Model (CDM) plus Logical Data Model (LDM) are shown for express the order and flow of information in the system

Finally, the section explains the main parts of the system, talking about their jobs in providing the important features of the platform.

3.2 System architecture

The innovative tourism platform's architecture is designed to provide a scalable, modular, and maintainable system that meets the varied requirements of end-users and service providers. It follows a Clean Architecture approach and is structured as a multitiered client-server model, making sure there is a clear break between the user view, business rules, and data entry levels.

3.2.1 Client-server architecture

The client-server architecture designates a mode of communication between several computers on a network. Client machines contact a server which provides them with services which are programs providing data such as files, a connection [20].

As applied in our project, where client apps (React web app and Flutter mobile app) talk to a central backend made in CSharp. The server takes care of all requests; it processes rules, talks with the database, and sends back answers to the client. This split helps keep things separate simplifies development, and improves scalability.

In this client-server architecture, the client computer sends a request for data to the server through the internet. Then, the server accepts the requested process and deliver the data packets requested back to the client.

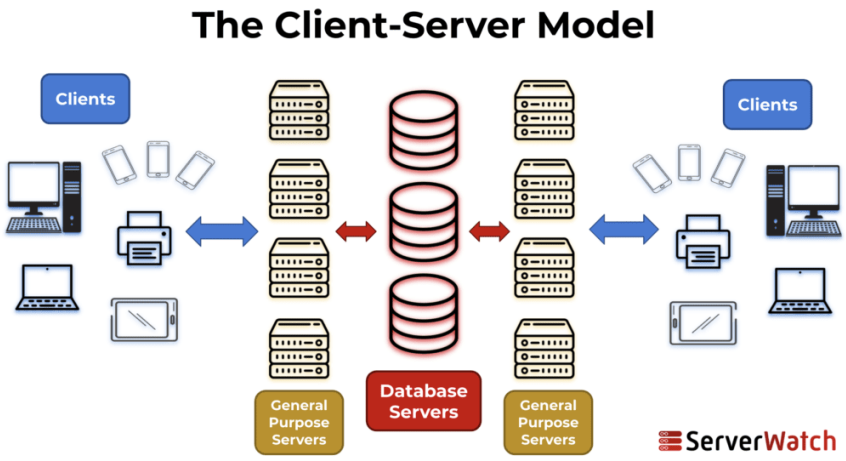

Figure 3.1: Client-Server Model.

Multitiered architecture

The system is divided into four distinct tiers:

- **Presentation layer:** User interfaces built with React (web) and Flutter (mobile) enable travelers and service providers to interact with the system.
- **Application layer:** A C# backend exposes RESTful APIs and contains all core logic (e.g., booking, search).
- **Business Layer:** This layer encapsulates the business rules and processes of the tourism system, ensuring proper coordination between different modules such as service validation, pricing logic, and user role management.
- **Data layer:** Uses PostgreSQL to store structured data such as users, partners, bookings, and service offers.

This separation of responsibilities facilitates maintainability, improves testability, and supports potential service scaling.

3.2.2 Clean architecture

The backend architecture of the proposed tourism app adheres to the paradigms of **Clean Architecture**, as defined by Robert C. Martin [1]. This engineering stresses partition of concerns, autonomy of systems, and turnabout of control, making the framework more viable, versatile, and testablee.

Clean architecture layers

The system is organized into concentric layers, each with a specific responsibility:

- **Entities (Domain layer):** This innermost layer contains the core business models and logic. It is completely independent of external libraries and frameworks.
- **Use cases (Application layer):** This layer defines the application's business workflows and rules. It orchestrates the logic needed to fulfill specific user requests .

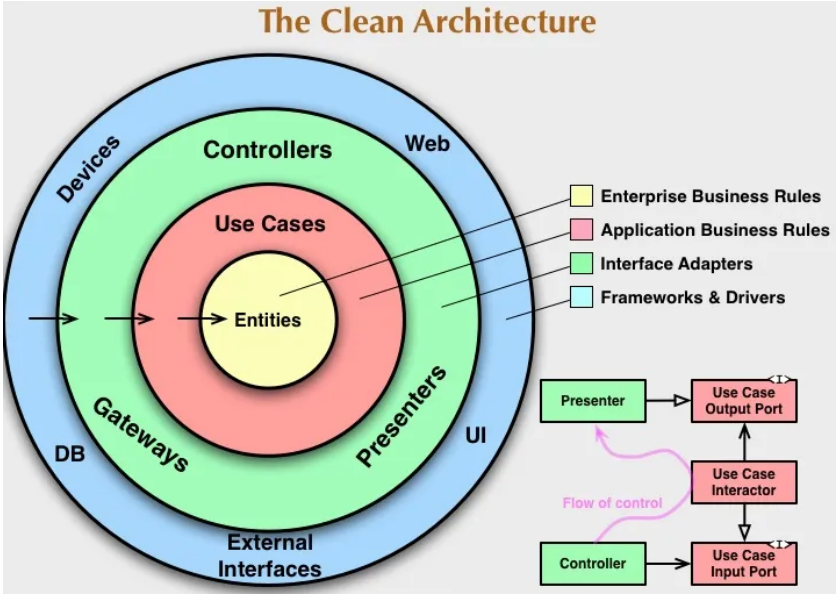

Figure 3.2: Clean Architecture [1].

- **Interface adapters (Presentation layer):** This layer contains controllers and gateways that convert data between the user interface and the application layer. It translates HTTP requests from the clients into method calls, and formats responses accordingly.
- **Infrastructure layer:** The outermost layer contains implementation details such as the database (PostgreSQL), external services (e.g., Google Maps API), and other technologies. These are injected into the inner layers through interfaces, following the Dependency Inversion Principle.

3.3 Definition of System Modules

The system is separated into multiple modules, each of which is in charge of a distinct set of functions, in order to guarantee maintainability, scalability, and modularity.

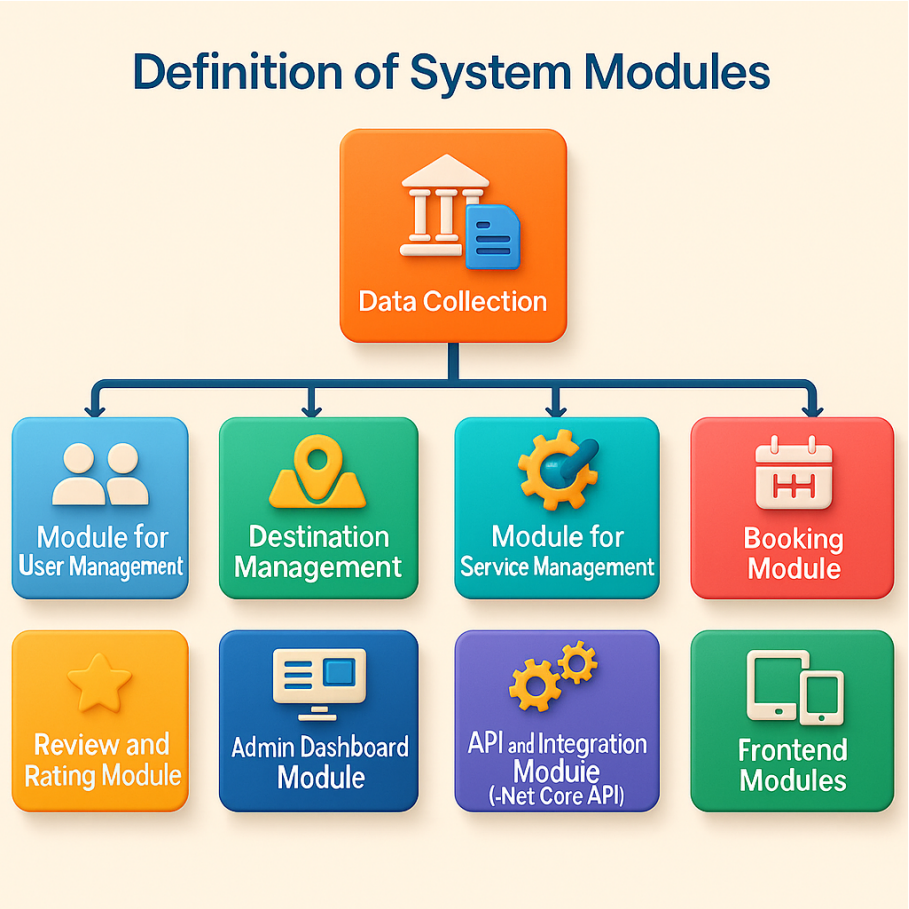

Figure 3.3: Diagram of System Modules.

1. **Data Collection:** Before proceeding with the technical system design, we conducted a comprehensive data collection phase to ensure that the platform is aligned with real-world tourism regulations and practices. This involved visiting the official Directorate of Tourism, where we obtained verified documents and detailed fiches listing all authorized travel agencies and hotels operating within the region. The collected documents included:

    - Updated lists of all licensed travel agencies and hotels.
    - Legal and administrative procedures required for a travel agency or hotel to obtain authorization.
    - Operational guidelines, required documentation, and service categories as defined by the local tourism authority.

    These trusted data sources served as the foundation for modeling our system require-

ments and defining the platform's service modules. This approach ensures that the services offered within the platform comply with current tourism laws, and that only verified agencies and hotels can register and operate.

2. **Module for User Management**

   - Manages role management (Tourist, ServiceProvider, Admin), profile updates, login, and user registration.
   - Guarantees safe authorization and authentication.
   - Offers email verification.

3. **Destination Management Module**

   - Admins oversee the names, descriptions, photos, and regions of tourist destinations.
   - Offers APIs for retrieving locations for front-end interface display.
   - Multimedia content and regional filtering are supported.

4. **Module for Service Management**

   - Gives service providers the ability to add, edit, and remove services.
   - Sorts services into different categories, such as hotel, tour, activity, and guide.
   - Manages service scheduling, cost, and availability.
   - Allows administrators to approve and moderate content.

5. **Booking Module**

   - Enables tourists to book service dates and display availability.
   - Tracks and manages statuses (Pending $\rightarrow$ Confirmed $\rightarrow$ Cancelled).
   - Calculates total cost and stores the booking record.
   - Notifies users of the booking status whether a confirmation, or cancellation.

6. **Review and Rating Module**

   - Average ratings are available for the services.

7. **Admin Dashboard Module**

    - A web interface, where Admin can ‘view the activity of the system.‘
    - Will provide statistics, user management, service approval, and destination selection.
    - Generates reports and insights based on the
    - systems use and revenues.

8. **API and Integration Module (.Net Core API)**

    - The core communication layer between the front end apps and the Database.
    - Implements our business logic and facilitates the validation, error handling, and security.
    - Is RESTful and token based.
    - Allows for further scaling with service modules.

9. **Frontend Modules**

    - Flutter Mobile App - For tourists to explore destinations and manage their bookings on the go.
    - React Web App - For service providers and admins to manage services, content and system data. Responsive UI + Analytics dashboard.

    Each module is to be completely self contained but have seamless integration with other modules and APIs through clearly defined interfaces .

3.4 Web and Mobile application architecture

To facilitate a seamless and consistent user experience regardless of the platform, the system is deployed with multitiered architecture for web and mobile. The multitiered architecture divides concerns into multiple layers, which enhances scalability, maintainability, and reusability. The system also integrates external services such as Google Maps API to provide additional functionality. Below is an accurate breakdown of each part:

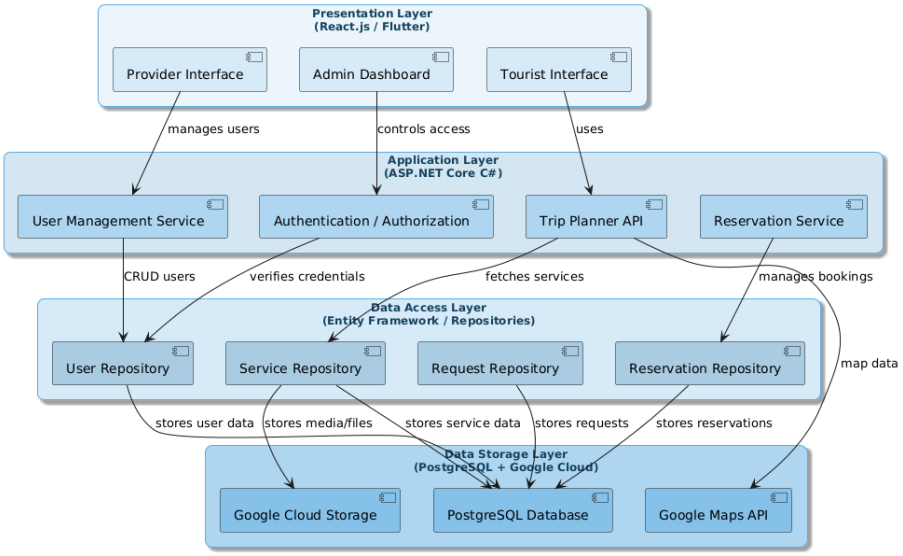

Figure 3.4: Architecture of web and mobile application.

3.4.1 Web application architecture

The web application follows a classic multitiered architecture, extended with additional external service integrations, making it closer to an N-tier model. The components include:

Presentation layer

The user interface is developed using React, a widely adopted JavaScript library for building dynamic and responsive front-end applications. it acts as a start spot for users it takes care of UI showing and user actions. The React front-end communicates to a server through not at the same time API asks (e.g,RESTful HTTP requests).

Application layer

The back-end of the application is implemented in C#, which is responsible for executing business logic, validating requests, managing sessions, and handling communication with both the database and external APIs. This layer acts as a bridge between the front-end and the data layer, ensuring logic processing and security.

Data layer

The system employs PostgreSQL, a powerful open-source relational database system, for storing and managing persistent data. It supports advanced querying capabilities and ensures data consistency and integrity.

External services layer

To enhance functionality and enrich the user experience, the system integrates multiple external APIs, such as mapping services. These services are accessed through the back-end, allowing the application to offer real-time and context-aware features.

3.4.2 Mobile application architecture

In parallel with the web application, a cross-platform mobile application was developed using Flutter, a modern UI toolkit by Google.

Mobile front-end

The mobile front-end is built with Flutter, offering a consistent and responsive user interface across Android and iOS devices. Flutter's widget-based design enables fast development and a native-like performance.

API integration

The Flutter mobile application communicates with the same C# back-end used by the web version. It consumes the same set of APIs to ensure data synchronization and consistency across platforms. This unification of logic and services reduces redundancy and simplifies maintenance.

3.5 UML Diagrams

In this section, we illustrate our platform functionalities which the user can benefit from. Services and features are shown in below.

3.5.1 Use case diagram

The use case diagram provides a high-level view of the interactions between the primary actors (Traveler, Client/,Admin) and the system.

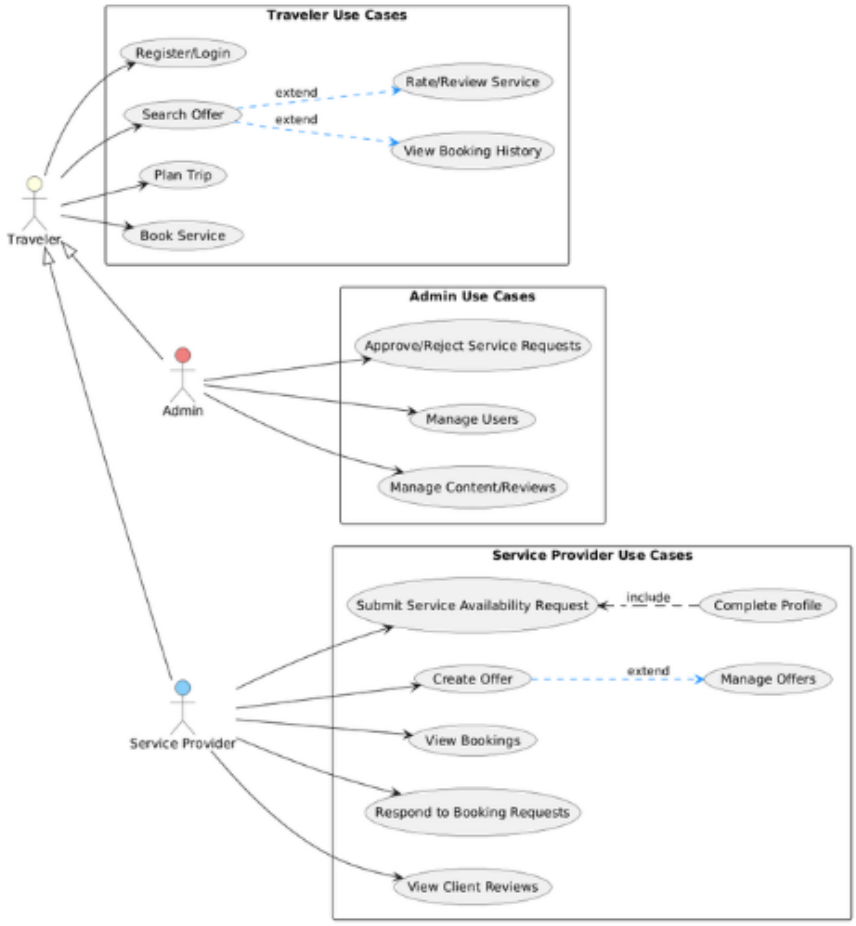

Figure 3.5: Use Case Diagramm.

3.5.2 Sequence diagram

The sequence diagram shows the dynamic behavior of the system by modeling the sequence of messages exchanged between objects to accomplish a specific function. It highlights the flow of interactions during use cases such as user registration.

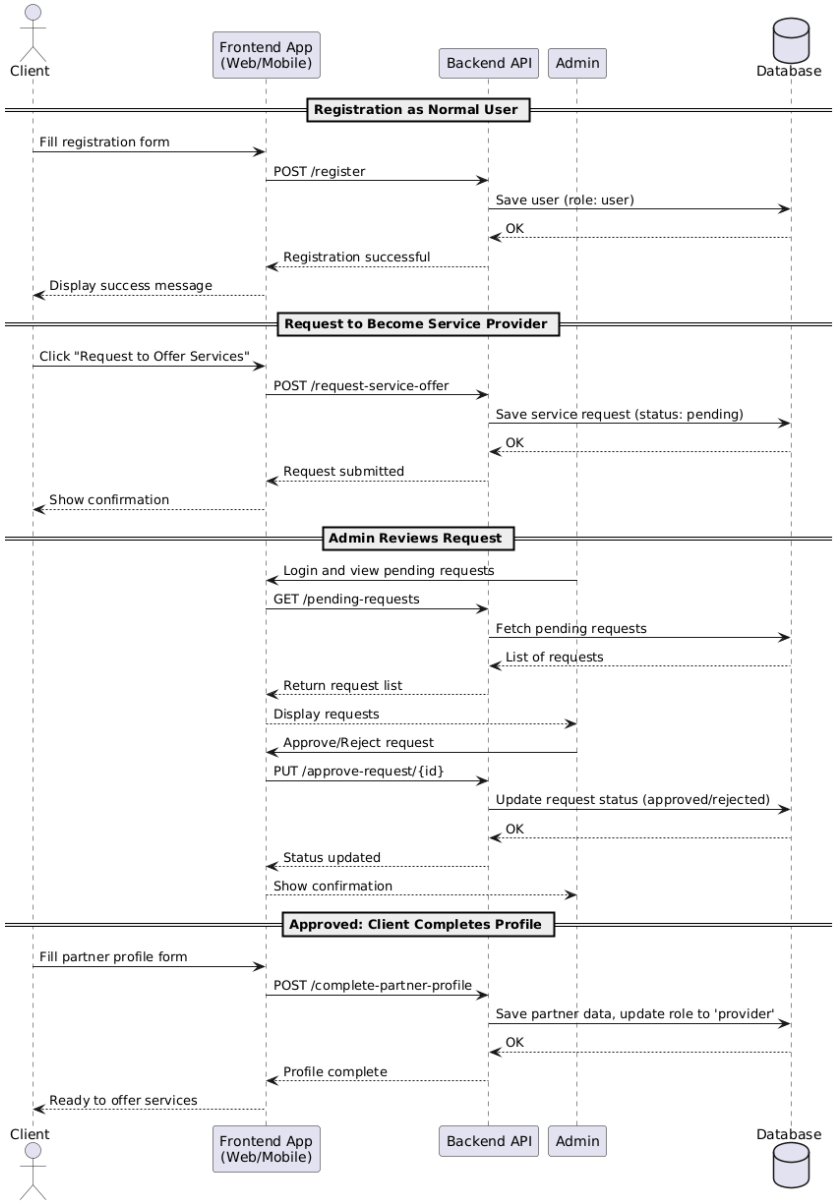

Figure 3.6: Sequence Diagram.

3.5.3 Class diagram

The class diagram presents the static structure of the tourism application by identifying the main entities involved It serves as a blueprint that organizes the business logic of the platform, supporting features like user registration, service request management, offer publishing, and reservation handling.

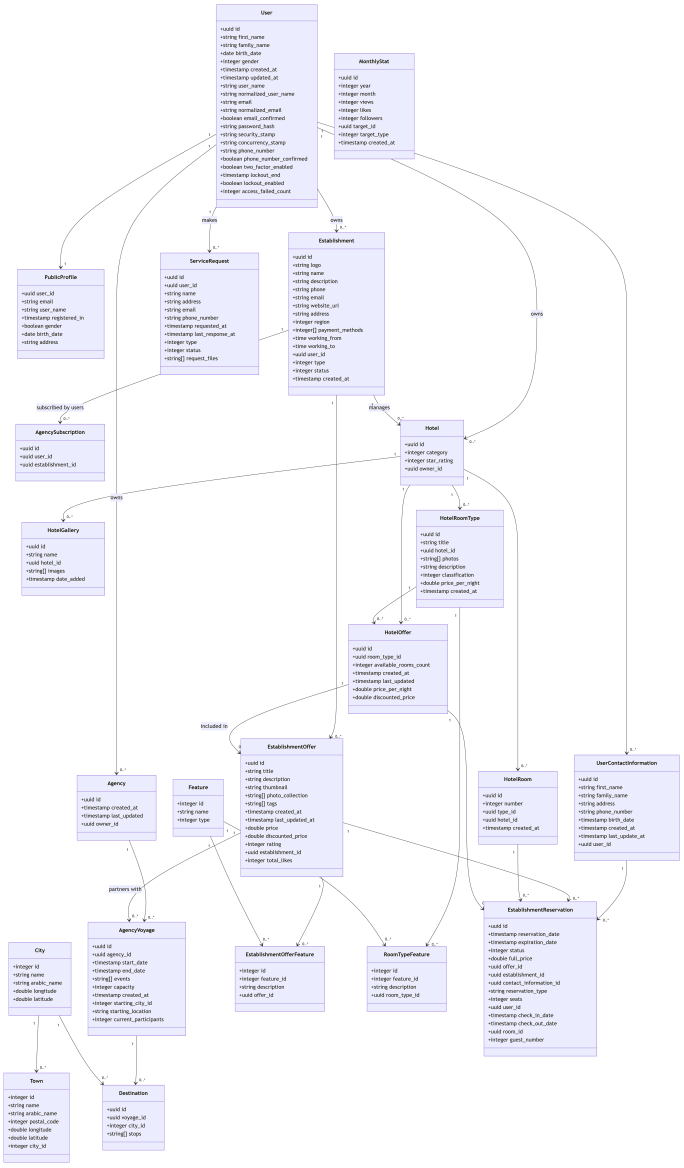

Figure 3.7: class diagram.

3.6 Used Algorithm

As part of developing our tourism platform, which connects travelers with local service providers (such as hotels, restaurants, guides, and activities), we have implemented a smart recommendation system to help users discover destinations and services that match their preferences. This system is based on Collaborative Filtering, a widely used recommendation technique.

3.6.1 Collaborative Filtering

Collaborative Filtering is a widely adopted recommendation technique that predicts a user's preferences by analyzing patterns of user-item interactions across a large group of users. It operates on the principle that individuals who shared similar opinions or behaviors in the past are likely to exhibit similar preferences in the future. This method does not require any content-related information about the items themselves, relying entirely on user behavior data to make personalized recommendations.[21].

We represent user interactions in the form of a user-service matrix, where:

- Each row corresponds to a user,
- Each column represents a tourism-related service (e.g., a hotel or tour),
- Each value indicates the user's interaction with that service (such as a rating or booking).

In our platform, we utilize:

User-Based Collaborative Filtering: Recommends services that have been liked or booked by users with similar behavior.

To further enhance the performance and scalability of collaborative filtering in our recommendation system, we employ Matrix Factorization as an advanced technique to uncover latent patterns in user-service interactions.

3.6.2 Matrix Factorization:

is a technique used to predict missing user-service interactions by decomposing a large, sparse matrix into the product of two smaller matrices: $R \approx P \times Q^T$

Where:

- R :is the user-service matrix (e.g., ratings or booking history).
- P :is the user-feature matrix.
- Q :is the service-feature matrix.

Each user and service is represented as a vector in a shared latent feature space

Mathematical Notation

Assume:

- m = number of users
- n = number of tourism services (hotels, trips, guides, etc.)
- k = number of latent features

Then:

$$R \in \mathbb{R}^{m \times n}$$

$$P \in \mathbb{R}^{m \times k}$$

$$Q \in \mathbb{R}^{n \times k}$$

The predicted interaction is:

$$R^{ij} = P_i \cdot Q_j^T$$

where:

$$P_i : \text{latent vector of user } i$$

$$Q_j : \text{latent vector of service } j$$

Example R - User-Service matrix (e.g., offer, ratings):

The goal is to predict the missing values (the question marks) using matrix factorization.

	Hotel A	Offer B	Agency C
User 1	5	?	3
User 2	4	2	?
User 3	?	5	4

Table 3.1: Evaluation matrix between users and services

Training the Model

We optimize the matrices P and Q to minimize the following loss function:

$$\min_{P,Q} \sum_{(i,j)\in K} \left(R_{ij} - P_i \cdot Q_j^T\right)^2 + \lambda \left(\|P_i\|^2 + \|Q_j\|^2\right)$$

Where:

- K is the set of known (non-missing) values in R.
- λ is the regularization parameter to prevent overfitting.

Output

After training:

- We can predict unknown interactions.
- For example, the system estimates that User 1 would likely rate Offer B with 4.2.
- So we recommend Offer B to User 1.

3.7 Conclusion

This chapter outlined the design of the platform including the architecture, data structure, and function modules. The system architecture is multi-tiered providing mobile/web interfaces to a single .NET Core API with a PostgreSQL database, allowing for scalability and security.

The UML and ER diagrams captured the major entities, relationships, and interaction in the system and provided a good picture of the overall structure of the platform. The conceptual and logical data models described how the user data, services, bookings and reviews are organized and constrained.

Lastly, we describe the key system modules: user management, booking, services and administration - allowing for a modular development and a maintainable design. This design presents a reasonable for the implementation phase.

Chapter 4

Implementation and Development

4.1 Introduction

This chapter marks a new stage in our “My Way” tourism platform project, focusing on the system implementation. After completing the analysis and design phases, we now detail the development process and integration of the application’s components using modern technologies.

We first present the development environment, including the tools and technologies used for both the mobile and web versions. Then, we explain how key modules were implemented, along with challenges faced and solutions applied.

The chapter concludes with a summary of the results, illustrated through interface screenshots and feature demos, showing the platform’s performance and usability. Overall, this chapter demonstrates how the initial designs were successfully turned into a functional application aligned with the project’s goals.

4.2 Development Environment

This section outlines the tools, technologies, and platforms used throughout the development of our tourism platform. Choosing the right development environment was essential to ensure efficient collaboration, scalability, and compatibility across mobile and web platforms. We describe the software stack adopted, including programming languages, frameworks, databases, and development tools, as well as the rationale behind these choices.

4.2.1 Development Tools

Visual Studio Code: Visual Studio Code is a lightweight yet powerful source code editor that runs on your desktop and is available for Windows, macOS, and Linux. It comes with built-in support for JavaScript, TypeScript, and Node.js, and boasts a rich ecosystem of extensions for other languages and runtimes such as C++,C#, Java, Python, PHP, Go, and .NET. VS Code also includes debugging, task running, and version control, making it a versatile development tool[22].

Figure 4.1: Visual Studio Code Logo

Android Studio: Android Studio is the official integrated development environment (IDE) provided by Google for building Android applications. It is based on JetBrains' IntelliJ IDEA and supports programming languages such as Kotlin, Java, and C++. Android Studio offers powerful tools for code editing, user interface design, performance analysis, debugging, and testing. It also includes an advanced emulator and a Gradle-based build system, enabling efficient and scalable app development across different Android devices. The IDE is cross-platform and available for Windows, macOS, Linux, and Chrome OS[23].

Figure 4.2: Android Studio Logo

JetBrains Rider: JetBrains Rider is a powerful, cross-platform integrated development environment (IDE) designed primarily for.NET and .NET Core development. Developed by JetBrains, Rider combines the IntelliJ platform with ReSharper's code analysis capabilities, offering intelligent code completion, refactoring, and navigation features. It supports multiple programming languages such as C#, VB.NET, ASP.NET, JavaScript,TypeScript, and more. Rider includes built-in support for front-end technologies, unit testing, version control systems, and database tools, making it a versatile environment for full-stack.NET development on Windows, macOS, and Linux[24].

Figure 4.3: JetBrains Rider Logo

Flutter: Flutter is an open-source UI toolkit developed by Google for building natively compiled applications for mobile, web, and desktop from a single codebase. It uses the Dart programming language and provides a rich set of pre-designed widgets that ensure a consistent and expressive user interface. Flutter is known for its fast development cycle through "hot reload," high performance, and strong support for cross-platform app development. Its flexibility and growing ecosystem make it a popular choice for developers targeting Android, iOS, Windows, macOS, Linux, and the web[25].

Figure 4.4: Flutte Logo

Dart: Dart is an open-source, class-based, object-oriented programming language developed by Google, optimized for building high-performance, multi-platform applications,It serves as the primary language of the Flutter SDK, providing the language syntax and runtime environment that underpin Flutter's cross-platform UI toolkit[26].

Figure 4.5: Dart Logo

JavaScript: JavaScript is a high-level, interpreted programming language that enables dynamic behavior on websites. It is widely used for client-side web development, allowing developers to create interactive and responsive user interfaces across all major browsers[27].

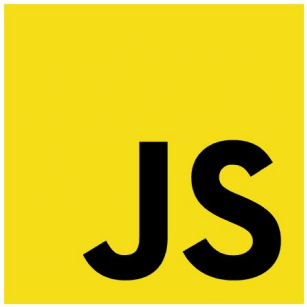

Figure 4.6: JavaScript Logo

4.2.2 Backend Development and API Tools

.NET Core:.NET Core is a cross-platform, open-source framework developed by Microsoft for building modern, cloud-based, and internet-connected applications. It supports multiple programming languages and enables development for Windows, macOS, and Linux environments[28].Chosen to build RESTful APIs for the backend due to its high performance, scalability, and strong support for web services.

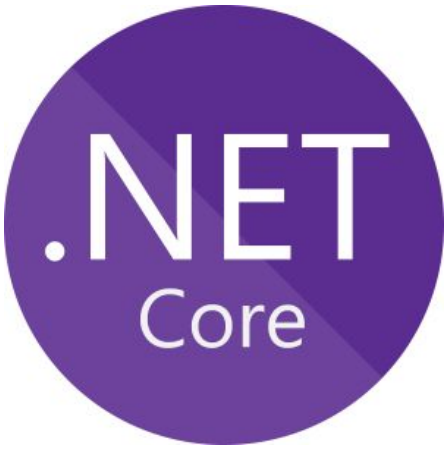

Figure 4.7: .NET Core Logo

Node.js: Node.js is an open-source, cross-platform runtime environment that allows developers to execute JavaScript code on the server side. Built on the V8 JavaScript engine, it is designed for building scalable network applications and is known for its event-driven, non-blocking I/O model [29].

Figure 4.8: Node.js Logo

4.2.3 Database Management

PostgreSQL: PostgreSQL is a powerful, open-source relational database management system (RDBMS) known for its reliability, feature richness, and standards compliance. It supports advanced data types, complex queries, and extensibility, making it suitable for a wide range of applications[30].

Figure 4.9: PostgreSQL Logo

4.2.4 API Development and Testing

Swagger: Swagger is an open-source framework used for designing, building, documenting, and consuming RESTful web services. It provides tools such as the Swagger UI and Swagger Editor, enabling developers to define APIs using the OpenAPI Specification in a standardized and human-readable format[31].

Figure 4.10: Swagger Logo

4.2.5 Version Control and Collaboration

GitHub: GitHub is a cloud-based platform where you can store, share, and collaborate on code. Storing your code in a "repository" on GitHub allows you to:

- Showcase or share your work.
- Track and manage code changes over time.
- Let others review and suggest improvements.
- Collaborate without disrupting others' work.

Collaborative working is made possible by Git, the open-source version control system upon which GitHub is built.[32]

Figure 4.11: Git hub Logo

ClickUp: ClickUp is an all-in-one, cloud-based productivity platform designed to streamline project management and team collaboration. It integrates tasks, documents, chat, whiteboards, spreadsheets, and more into a unified workspace, enabling teams to plan, track, and manage workflows efficiently. Founded in 2017 by Zeb Evans and Alex Yurkowski, ClickUp offers customizable features suitable for various industries and team sizes.[33]

Figure 4.12: ClickUp Logo

4.2.6 Design Tools

Figma: Figma Design is for people to create, share, and test designs for websites, mobile apps, and other digital products. It is a popular tool for designers, product managers, writers, and developers. Figma helps everyone involved in the design process contribute, give feedback, and make better decisions faster.[34]

Figure 4.13: Figma Logo

4.3 Interface System

As mentioned in previous chapters, our tourism application is available on both web and mobile platforms. Users whether tourists or service providers interact with a range of dedicated interfaces. Each service is equipped with its own interface, specifically designed to be intuitive, user-friendly, and optimized for seamless interaction across devices.

4.3.1 Interface system for web Application

Now, we will present the interface system of the web application

Home page

The home page serves as the main entry point of the tourism application, providing users with quick access to featured destinations, available services, and personalized recommendations. It offers a user-friendly interface that highlights the platform's key features and latest offers.

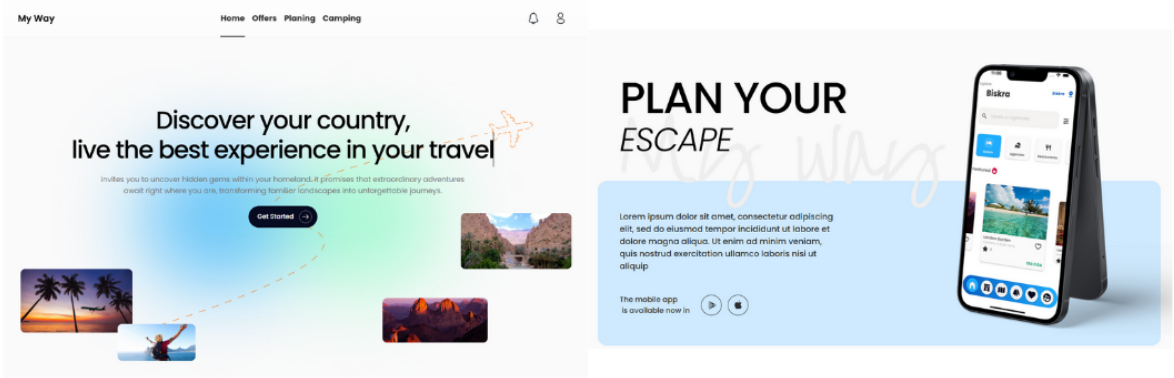

Figure 4.1: Home page.

Sign In and Sign Up

The sign in and Sign up sections allow users to securely access the tourism platform. New users can create an account through the Sign Up page, while existing users can log in using their credentials via the Sign In page.

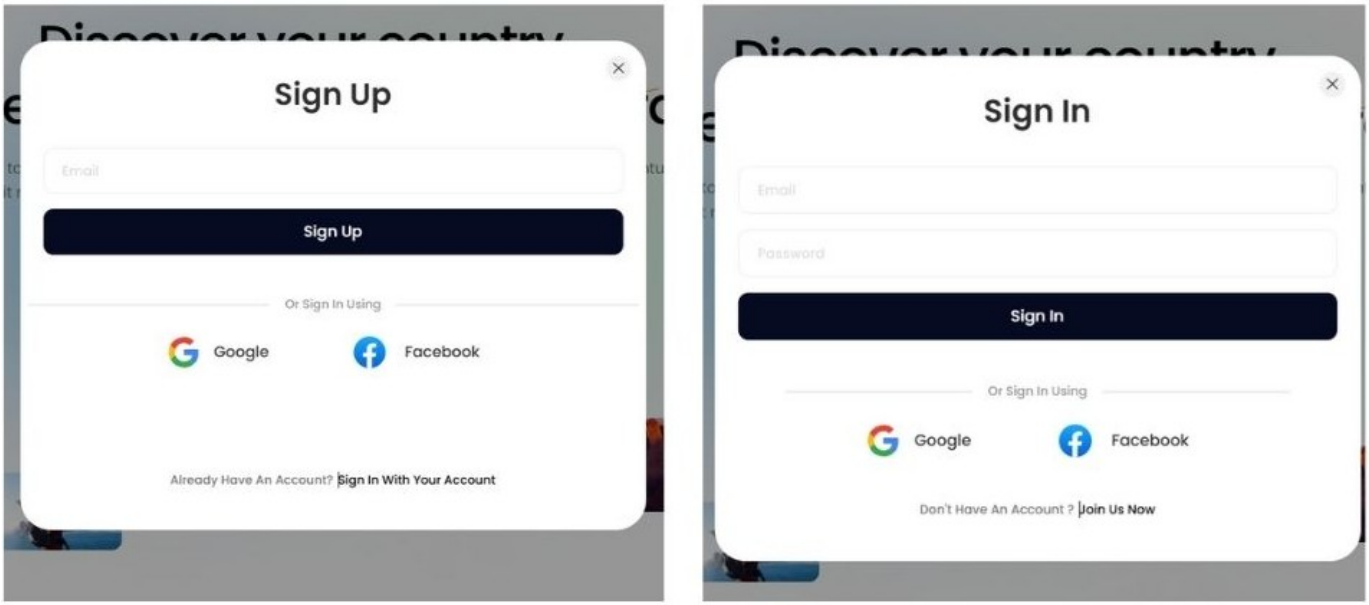

Figure 4.2: Sign In and Sign Up.

Request new service

The request new service section allows users or partners to submit a request to offer a new tourism-related service on the platform. This request is reviewed by the admin to ensure it meets the platform's standards before approval and publication.

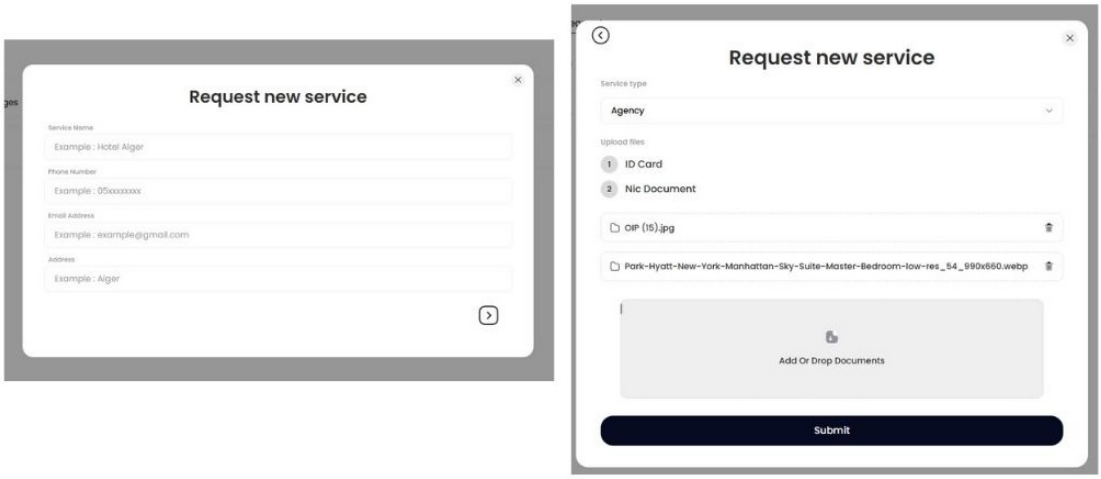

Figure 4.3: Request new service.

Admin dashboard

The Admin plays a central role in the tourism platform by overseeing system operations. They are responsible for reviewing and approving service provider requests, and ensuring the overall integrity and smooth functioning of the platform.

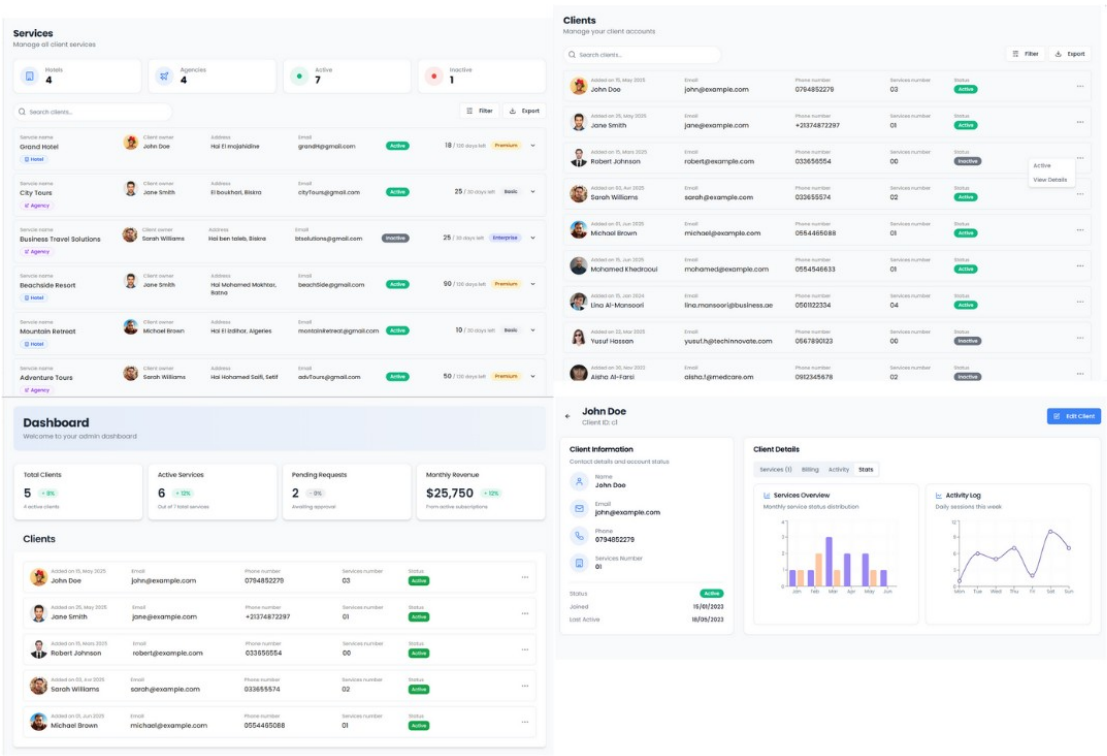

Figure 4.4: Admin dashboard.

General informations

This section displays general information about the user's profile, including personal details.

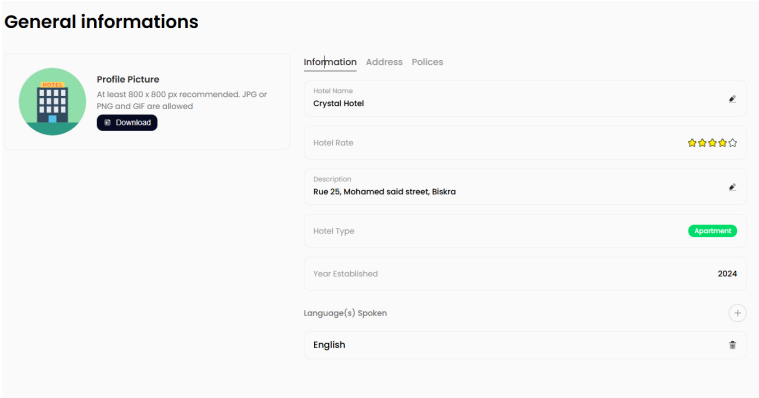

Figure 4.5: General informations.

Add offer

The add offer section allows service providers to create and submit new tourism offers, such as guided tours, accommodations, or activity packages. Each offer includes detailed information to attract tourists .

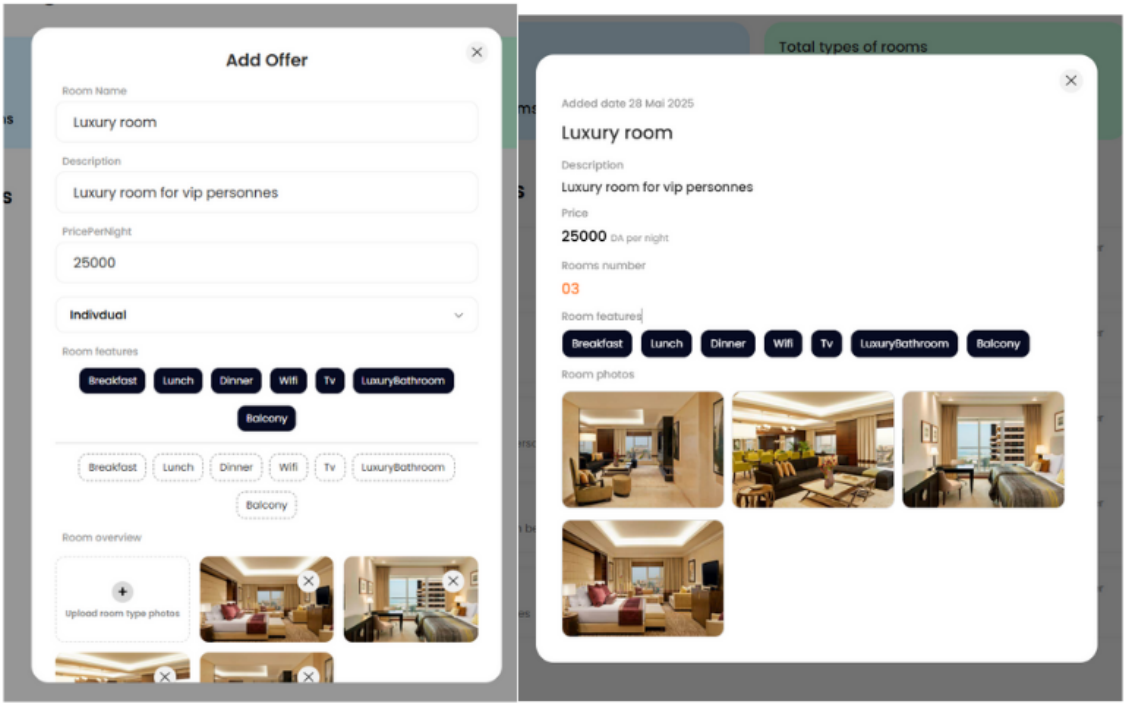

Figure 4.6: Add offer.

Rooms management

The rooms management section enables service providers to add, update, or remove room listings. It allows them to manage room details such as type, availability, pricing, and capacity, ensuring accurate information is displayed for tourists when booking accommodations.

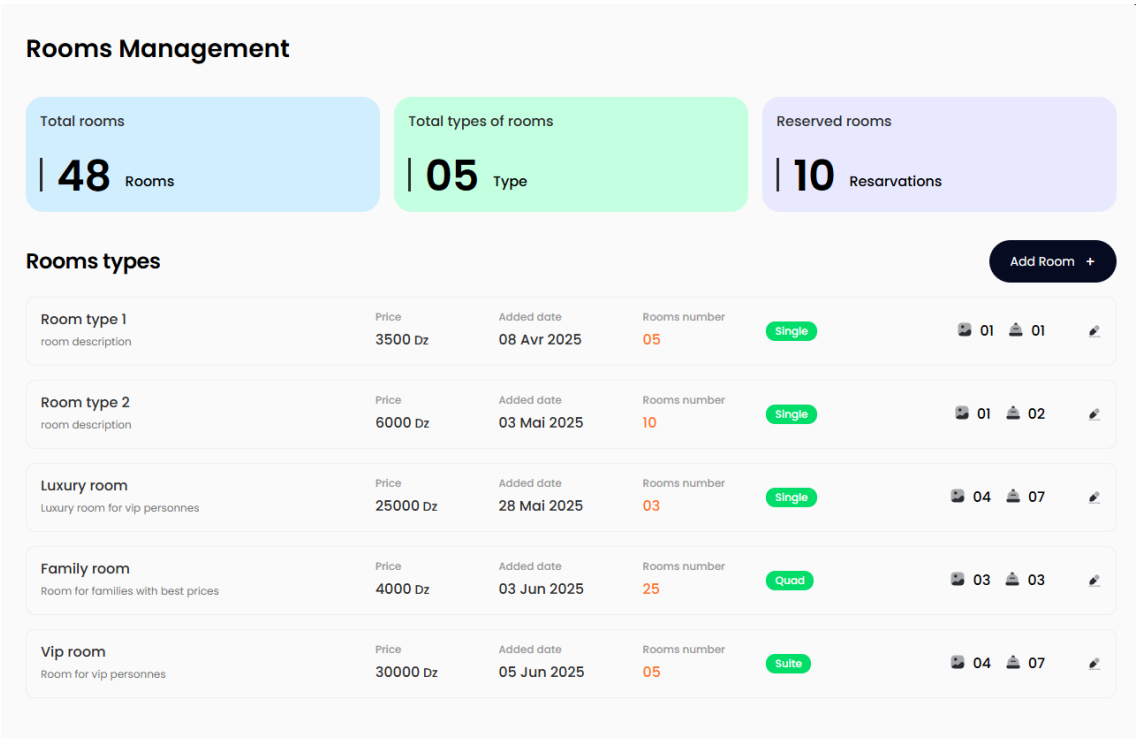

Figure 4.7: Rooms management.

Agency offers

The agency offers section showcases special packages and services provided by partnered travel agencies. It allows tourists to explore curated tours, deals, and exclusive experiences tailored to enhance their travel plans.

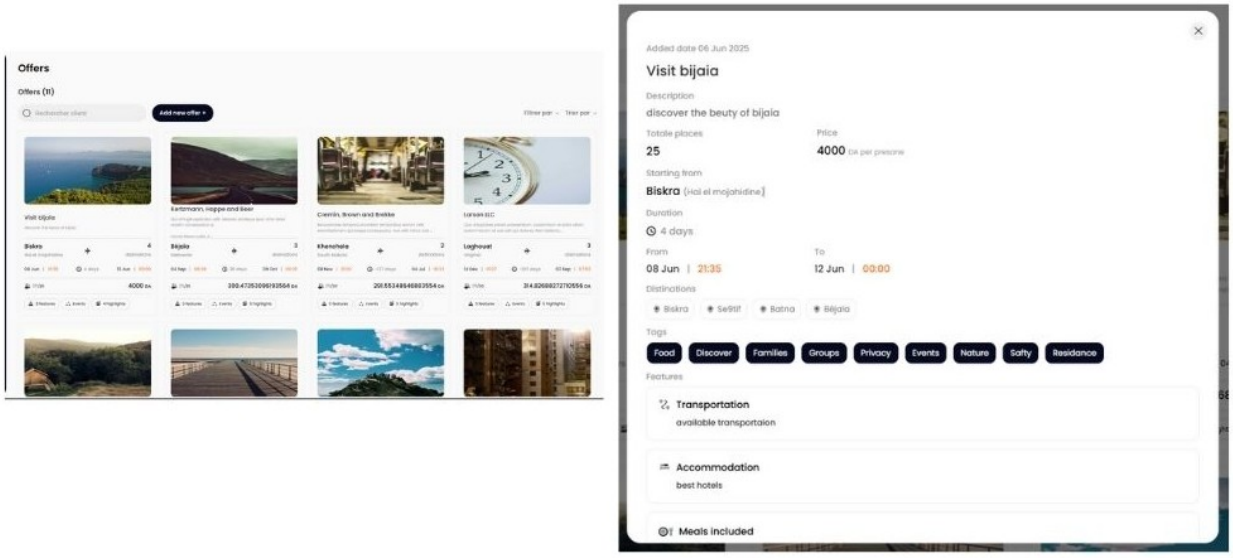

Figure 4.8: Agency offers.

Manage the list of services

The manage the list of services section allows service providers to view, update, and manage the services they offer on the platform. This includes editing service details, monitoring their status, and tracking submitted service requests, ensuring their offerings remain accurate and up to date.

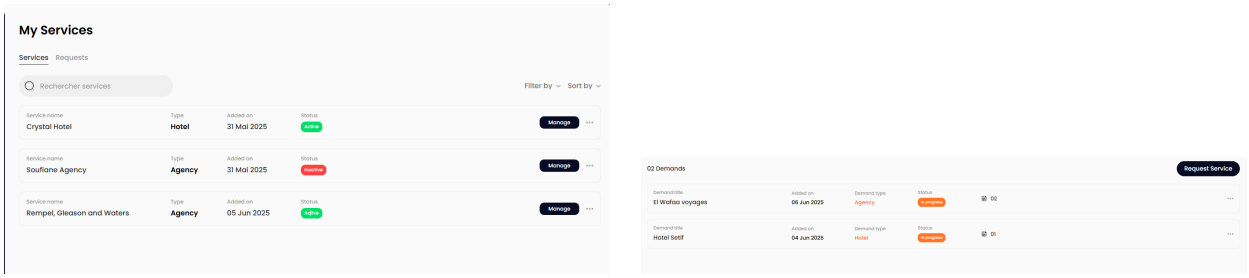

Figure 4.9: Manage the list of services.

4.3.2 Interface system for mobile Application

Now, we will present the interface system of the mobile application:

Home page

This is the home page for mobile application:

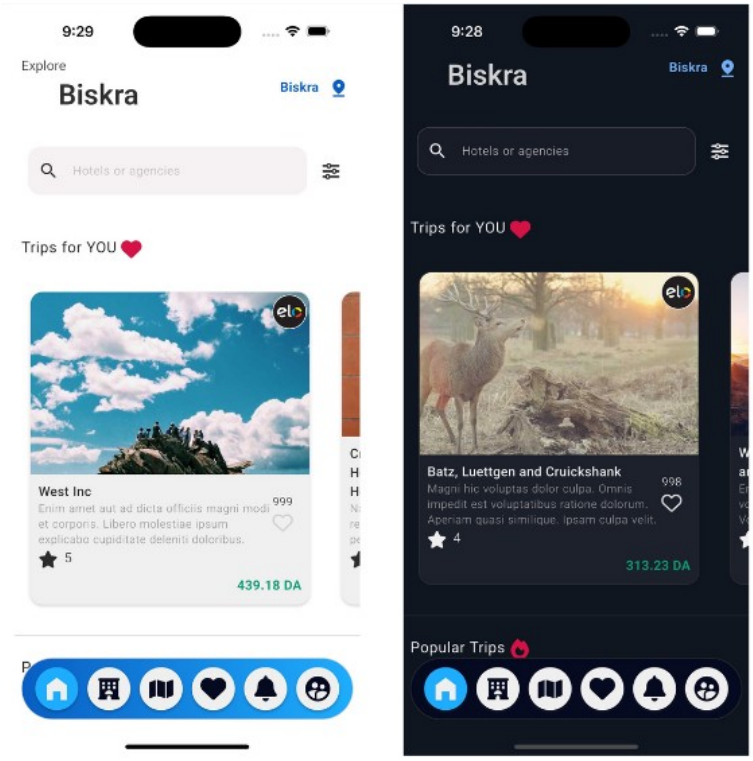

Figure 4.10: Home page.

Login

This is the login page for mobile application:

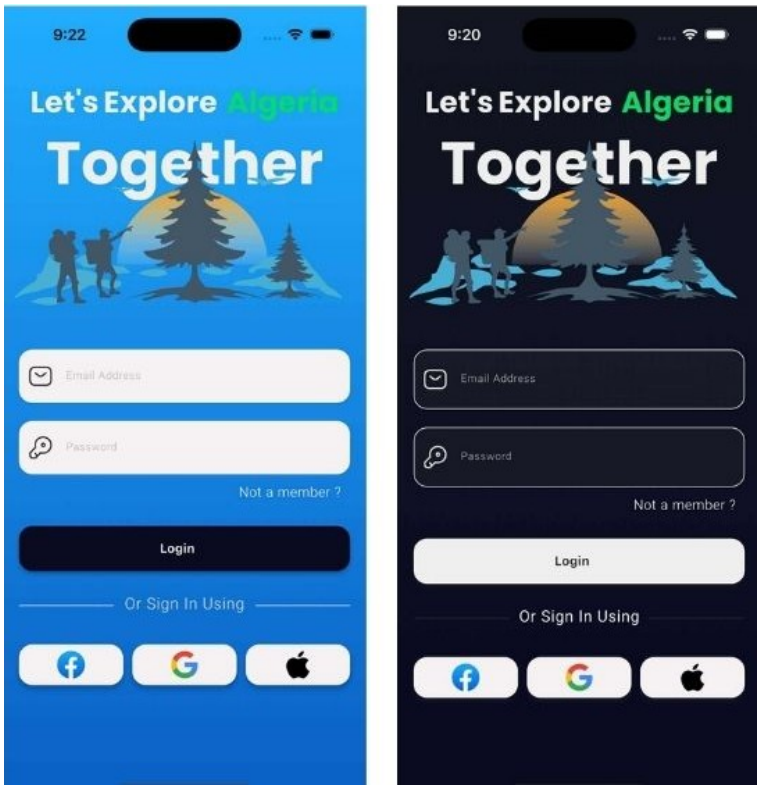

Figure 4.11: Login.

Request new service

This is the Request new service page for mobile application:

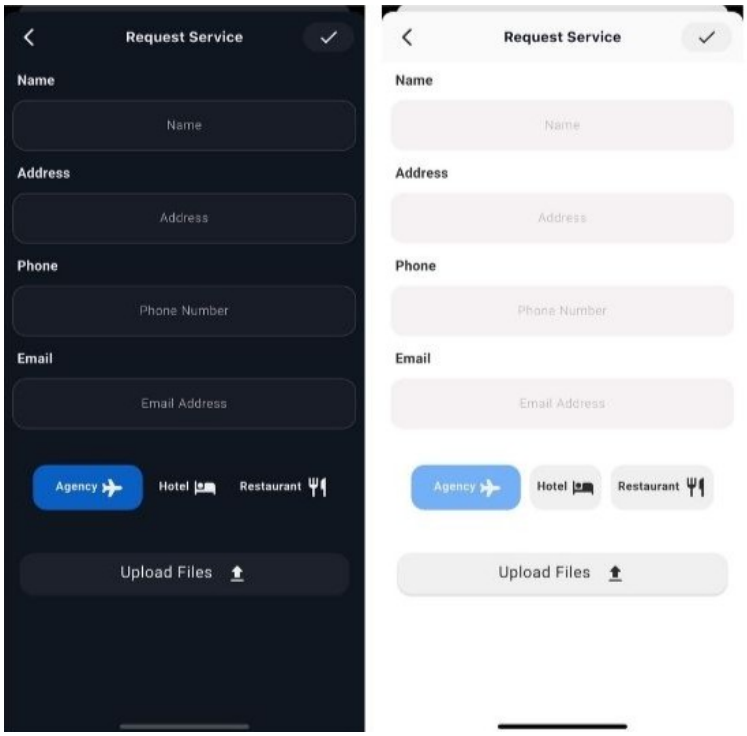

Figure 4.12: Request new service.

Voyage details entry form

An interface for adding new voyages, including fields for title, description, price, discounted price, capacity, and selecting voyage dates.

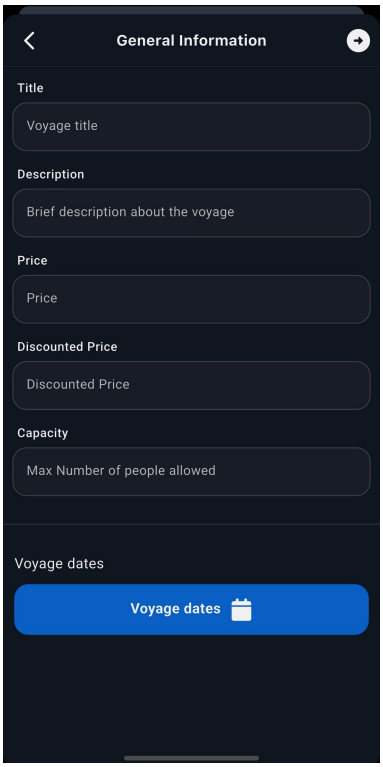

Figure 4.13: Voyage details entry form.

Sorting and filtering panel

Users can sort voyages by "Latest" or "Popularity" and apply filters like starting city, destination city, and price range using sliders. helping users narrow down their voyage search based on budget and travel preferences.

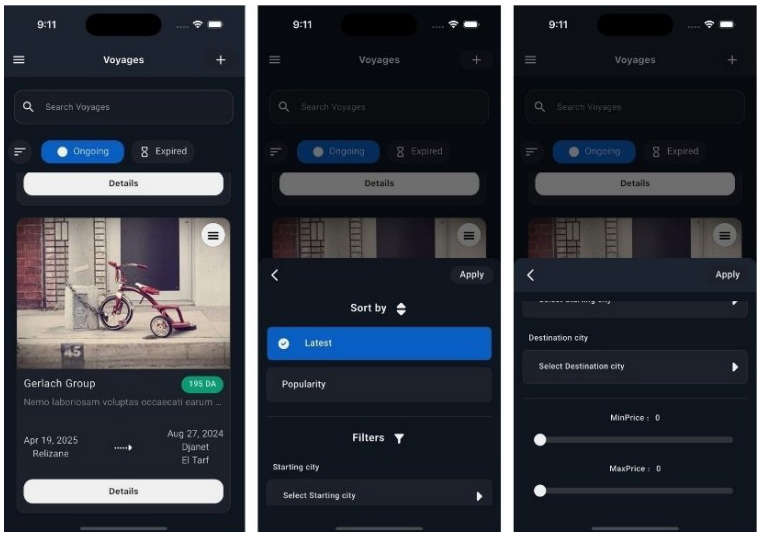

Figure 4.14: Sorting and filtering panel.

Hotel Offers

A hotel offers listing interface showing rooms with types (Single, Double, Triple), pricing, and images.

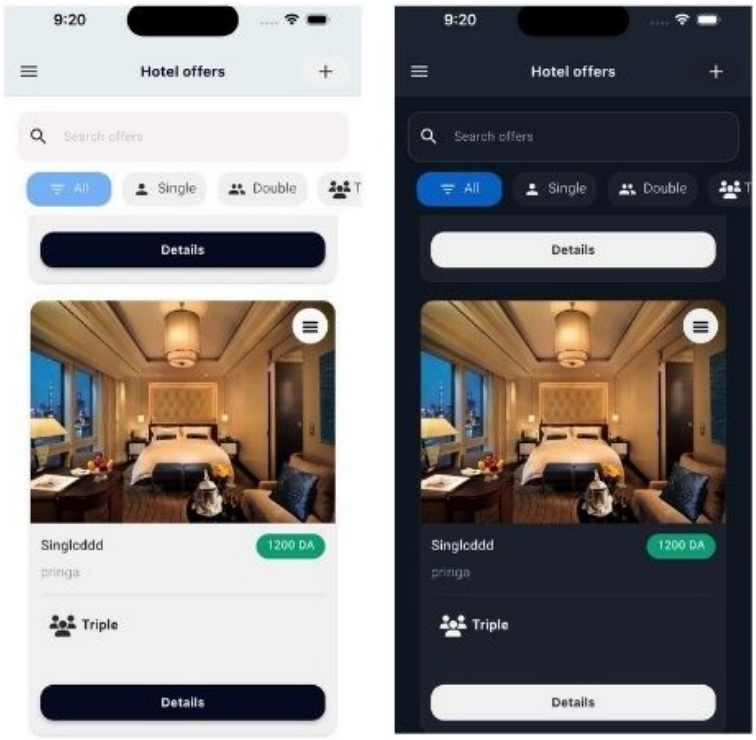

Figure 4.15: Hotel offers.

4.4 Conclusion

This chapter presented the development environment and detailed the design and implementation of the system interface. It outlined the tools and technologies selected to ensure a stable and scalable foundation, while emphasizing the importance of user experience through an intuitive and responsive interface. These elements play a crucial role in ensuring the system's usability, performance, and readiness for real world deployment.

Conclusion and Perspectives

Conclusion

This project aims to develop a tourism platform called "My Way," to facilitate trip planning and service booking for both tourists and those exploring Algeria. The platform provides a personalized experience by gathering accurate information about tourist destinations, including accommodation options, helping users organize trips with ease. The platform also relies on modern technologies to analyze user preferences and suggest a personalized travel experience tailored to their interests and budgets, promoting domestic tourism and attracting more visitors to various regions of Algeria.

Summary of the Work Completed

In its current version, the platform serves as a functional prototype, focusing on a single willaya"BISKRA". The key accomplishments include:

- Designing a responsive user interface for both web and mobile platforms using React and Flutter respectively.
- Implementing core features such as user registration, destination browsing, basic booking system,recommendation system, and service listing.
- Developing a .NET-based backend connected to a PostgreSQL database.
- Integration of a local payment gateway to support in-app transactions.
- Collaboration with real tourism service providers in the willaya.
- Supporting multilingual access (Arabic, English) to cater to a wide range of users.

This first version represents a solid foundation for the future development of a national-scale smart tourism solution.

Perspectives

To meet the broader vision of promoting Algeria as a top travel destination, several improvements and expansions are planned:

- **Nationwide Coverage:** Integration of all 58 wilayas, each with its own content, services, and tourism offerings.
- **Smart Personalization:** Use of AI technologies to offer personalized itineraries, smart recommendations, and a virtual travel assistant.
- **Advanced Payment System:** Addition of international payment methods, installment plans, loyalty programs, and multi-currency support.
- **Social and Community Features:** Enabling users to share travel stories, join forums, participate in group planning, and connect via chat.
- **Environmental and Social Responsibility:** Tools for eco-friendly travel, support for sustainable tourism, and options to contribute to local communities.
- **Technical Enhancements:** Integration of offline mode, augmented reality, and progressive web app (PWA) support.

In conclusion, this project lays the groundwork for a modern and scalable tourism platform that has the potential to revolutionize the way people explore Algeria, empower local providers, and promote the country's rich cultural and natural heritage on a global scale.

References

[1] Robert C. Martin. The clean architecture. https://blog.cleancoder.com/uncle-bob/2012/08/13/the-clean-architecture.html, 2012. Accessed: 2025-05-24.

[2] Teresa Borges Tiago, Fátima Veríssimo, et al. Digital transformation and tourism: Evolution through web technologies. *Tourism Management Perspectives*, 37:100777, 2021.

[3] Sergey E Barykin, Elena de la Poza, Bilal Khalid, Irina Vasilievna Kapustina, Olga Vladimirovna Kalinina, and Kanwar Muhammad Javed Iqbal. Tourism industry: Digital transformation. In *Handbook of research on future opportunities for technology management education*, pages 414–434. IGI Global, 2021.

[4] José Francisco Perles-Ribes, Rafael Oliver-Romero, and Javier Ramón-Viñuela. Tourism growth and economic development: Is tourism-led growth hypothesis valid for developing and developed countries? *Journal of Policy Research in Tourism, Leisure and Events*, 13(1):1–16, 2021.

[5] Ali Kiliclar, Musa Yalcin, and Mehmet Aslan. Economic impacts of tourism and their importance in the tourism industry. *International Journal of Business and Management Studies*, 10(2):45–54, 2018.

[6] Jin-Hyung Chang, Heesup Han, and Antonio Ariza-Montes. Community-based tourism and resident quality of life: The mediating role of community support. *Journal of Travel & Tourism Marketing*, 37(4):405–417, 2020.

[7] Xin Zhuang, Yawei Yao, and David C. Airey. Cultural sustainability and tourism: A review of developments in the literature. *Sustainability*, 11(24):7016, 2019.

[8] Amine Mekideche and Khaled Bouaza. Digital marketing in algerian tourism: Challenges, opportunities, and strategic recommendations. *Economics Researcher's Journal*, 11(1):15–28, 2024.

[9] Algerian embassy. Algeria tourist tours, 2022. Accessed: 2024-12-01.

[10] Ministry of Tourism and Handicrafts. Algerian tourism portal, 2023. Accessed: 2024-12-01.

[11] Ministry of Tourism and Handicrafts. Public service portal for the tourism sector, 2024. Accessed: 2024-12-01.

[12] Khadidja Hassaine and Meriem Houari. Digital transformation and the tourism sector in algeria: Obstacles and strategies. *European Journal of Electrical Engineering and Technology*, 3(4):45–56, 2023.

[13] Nacera Benamar. Challenges facing digital startups in algeria: The case of tourism sector. *Journal of North African Economies*, 15(1):98–112, 2024.

[14] Ali Meddahi and Rania Chikhi. The impact of digital challenges on the development of startups in the tourism sector in algeria. *ResearchGate Preprint*, 2023.

[15] Imane Bensaoula. Digital marketing in algerian tourism: Challenges, opportunities, and strategic recommendations. *ResearchGate Preprint*, 2023.

[16] Hespress English. Algeria aims to rival morocco in tourism by 2030, but institutional challenges may hold sector back, 2024.

[17] TripAdvisor. Tripadvisor: Travel reviews, compare prices and book, 2024. Accessed: 2025-05-07.

[18] Booking.com. Booking.com: Official site for booking hotels, flights, and travel packages, 2024. Accessed: 2025-05-07.

[19] GetYourGuide. Getyourguide: Book travel experiences and activities online, 2024. Accessed: 2025-05-07.

[20] Ait Issab Tassadit and Rahmani Sarra. *Conception et réalisation d'une application web JEE pour la gestion des investissements Cas: ENIEM*. PhD thesis, Université Mouloud Mammeri, 2016.

[21] Xiaoyuan Su and Taghi M Khoshgoftaar. A survey of collaborative filtering techniques. *Advances in Artificial Intelligence*, 2009:1–19, 2009.

[22] Microsoft. Visual studio code, 2025. Consulté le 25 mai 2025.

[23] Android Developers. Android studio. https://developer.android.com/studio, 2025. Accessed: 2025-05-25.

[24] JetBrains. Rider: Cross-platform .net ide. https://www.jetbrains.com/rider/, 2025. Accessed: 2025-05-25.

[25] Google Developers. Flutter. https://flutter.dev/, 2025. Accessed: 2025-05-25.

[26] Dart Team. Dart overview, 2025. Accessed: 2025-05-25.

[27] MDN Web Docs. Javascript — mdn web docs. https://developer.mozilla.org/en-US/docs/Web/JavaScript, 2025. Accessed: 2025-05-25.

[28] Microsoft Docs. .net core guide. https://learn.microsoft.com/en-us/dotnet/core/, 2025. Accessed: 2025-05-25.

[29] Node.js Contributors. Node.js official documentation. https://nodejs.org/en/docs, 2025. Accessed: 2025-05-25.

[30] PostgreSQL Global Development Group. Postgresql documentation. https://www.postgresql.org/docs/, 2025. Accessed: 2025-05-25.

[31] SmartBear Software. Swagger open source tools. https://swagger.io/tools/, 2025. Accessed: 2025-05-25.

[32] GitHub. About github and git. https://docs.github.com/en/get-started/start-your-journey/about-github-and-git, 2025. Accessed: 2025-05-25.

[33] ClickUp. Clickup: The everything app for work. https://clickup.com/, 2025. Accessed: 2025-05-25.

[34] Figma. What is figma? https://help.figma.com/hc/en-us/articles/14563969806359-What-is-Figma, 2025. Accessed: 2025-05-25.